Senographe Pristina™
Senographe Pristina™ 3D
SenoBright™ HD
Pristina Serena™
Pristina Serena™ 3D
Pristina SerenaBright™

System Version:
7.70.50
7.70.60

DICOM CONFORMANCE STATEMENT

DOC2512847 rev 2
Copyright© 2021 by General Electric Company
All Rights Reserved.

This page is intentionally left blank.

CONFORMANCE STATEMENT OVERVIEW

Table 1 provides an overview of the network services supported by Senographe Pristina, Senographe Pristina 3D, SenoBright HD, Pristina Serena, Pristina Serena 3D and Pristina SerenaBright.

All features applying to Senographe Pristina 3D and Pristina Serena 3D only, will be identified with **"[3D only]"**

All features applying to SenoBright HD – CESM images only, will be identified with **"[CESM only]"**

All features applying to Pristina Serena – Biopsy images only, and Pristina SerenaBright – CESM Biopsy images, will be identified with **"[Biopsy only]"**

TABLE 1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Digital Mammography X-Ray Image Storage – For Presentation	Yes	Yes
Digital Mammography X-Ray Image Storage – For Processing	Yes	Yes
Breast Tomosynthesis Image Storage [3D only]	Yes [3D only]	No
Computed Tomography Image Storage [3D only]	Yes [3D only]	No
Secondary Capture Image Storage*	Yes	Yes
X-Ray Radiation Dose Structured Report Information Storage	Yes	Yes
Verification SOP Class	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model - MOVE	Yes	No
Workflow Management		
Storage Commitment Push Model SOP Class	Yes	No
Modality Performed Procedure Step SOP Class**	Yes	No
Modality Worklist Information Model – FIND SOP Class	Yes	No
Print Management		
Basic Grayscale Print Management Meta SOP Class	Yes	No
Printer SOP Class	Yes	No

NOTE: *Secondary capture Image can be received or sent but the system does not generate them.
** Not applicable for 2D biopsy, 3D biopsy and CESM Biopsy.

Table 2 provides an overview of the Media Storage Application Profiles supported by Senographe Pristina.

TABLE 2 – MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk – Recordable		
General Purpose CD-R	FSC	Yes
DVD		
General Purpose JPEG DVD	FSC	Yes
USB		
General Purpose JPEG USB	FSC	Yes

CONTENTS

1 INTRODUCTION 9

1-1 Overview 9

1-2 Overall DICOM Conformance Statement Document Structure 10

1-3 Intended Audience 11

1-4 Scope and Field of Application 11

1-5 Important Remarks 11

1-6 References 12

1-7 Definitions 12

1-8 Symbols and Abbreviations 14

2 NETWORK CONFORMANCE STATEMENT 16

2-1 Introduction 16

2-2 Implementation Model 16

2-2-1 Application Data Flow Diagram 16

2-2-2 Functional Definition of AE's 19

2-3 AE Specifications 20

2-3-1 DICOM SERVER AE Specification 20

2-4 Communication Profiles 54

2-4-1 Supported Communication Stacks 54

2-4-2 Physical Media Support 54

2-4-3 Additional Protocols 54

2-4-4 IPv4 and IPv6 Support 54

2-5 Extensions / Specializations/ Privatizations 55

2-5-1 Standard Extended / Specialized / Private SOP Classes 55

2-5-2 Private Transfer Syntaxes 55

2-6 Configuration 56

2-6-1 AE Title/Presentation Address Mapping 56

2-6-2 Configurable Parameters 56

2-7 Support of Extended Character Sets 57

2-8 Security Profiles 58

3 MEDIA STORAGE CONFORMANCE STATEMENT 59

3-1 Introduction 59

3-2 Implementation Model 59
3-2-1 Application Data Flow Diagram 59
3-2-2 Functional Definition of AE's 60
3-2-3 Sequencing of Real-World Activities 60
3-2-4 File Meta Information Options (See PS3.10) 60

3-3 AE Specifications 61
3-3-1 DICOM Media (CD/DVD/USB) Interchange AE Specification 61

3-4 Augmented and Private Application Profiles 63

3-5 Extensions / Specializations / Privatizations 63

3-6 Configuration 64

3-7 Support of Extended Character Sets 64

3-8 IHE Integration 64
3-8-1 IHE PDI 64

4 MODALITY WORKLIST QUERY IMPLEMENTATION 65

4-1 Modality Worklist Information Model Entity-Relationship Model 65
4-1-1 Entity Descriptions 66

4-2 Senographe Pristina Mapping of DICOM Entities 66

4-3 Modality Worklist Information Model Module 66

4-4 Information Model Keys 67
4-4-1 Supported Matching 67
4-4-2 Common Scheduled Procedure Step Entity Modules 68
4-4-3 Common Requested Procedure Entity Modules 72
4-4-4 Common Imaging Service Request Entity Modules 75
4-4-5 Common Visit Entity Modules 76
4-4-6 Common Patient Entity Modules 77

5 MODALITY PERFORMED PROCEDURE STEP IMPLEMENTATION 82

5-1 Introduction 82

5-2 Relationship between Scheduled and Performed Procedure Steps 82

5-3 Modality Performed Procedure Step Module Table 82

5-4 Modality Performed Procedure Step Module Definitions 82
5-4-1 SOP Common Module 82
5-4-2 Performed Procedure Step Relationship Module 82
5-4-3 Performed Procedure Step Information Module 84
5-4-4 Image Acquisition Results Module 85
5-4-5 Radiation Dose Module 86
5-4-6 Billing and Material Management Codes Module 86

5-5 Standard Extended and Private Data Attributes 86

5-6 Standard Extended and Private Context Groups 86

6 STORAGE COMMITMENT PUSH MODEL IMPLEMENTATION 87

6-1 Storage Commitment Push Model Information Object Definition 87
6-1-1 Storage Commitment Module for N-ACTION 87
6-1-2 Storage Commitment Module for N-EVENT-REPORT 87

7 BASIC DICOM DIRECTORY INFORMATION OBJECT IMPLEMENTATION 89

7-1 IOD Module Table 89

7-2 Information Module Definitions 89
7-2-1 File Set Identification Module 89
7-2-2 Directory Information Module 89
7-2-3 Definition of Specific Directory Records 90

8 PRINT MANAGEMENT IMPLEMENTATION 94

8-1 Introduction 94

8-2 Basic Film Session SOP Class 94
8-2-1 Basic Film Session N-Create Attributes 94

8-3 Basic Film Box SOP Class 94
8-3-1 Basic Film Box N-Create Attributes 94
8-3-2 Basic Film Box N-Action Attributes 95
8-3-3 Basic Film Box N-Delete 96

8-4 Basic Grayscale Image Box SOP Classes 96
8-4-1 Basic Grayscale Image Box Pixel N-Set Attributes 96

8-5 Printer SOP Class 96
8-5-1 Printer N-Event-Report Attributes 96
8-5-2 Printer N-Get Attributes 97

9 DIGITAL MAMMOGRAPHY X-RAY INFORMATION OBJECT IMPLEMENTATION 98

9-1 Introduction 98

9-2 MG IOD Implementation 98

9-3 MG Entity-Relationship Model 98
9-3-1 Entity Descriptions 99
9-3-2 Senographe Pristina Acquisition Workstation Mapping of DICOM entities 100

9-4 IOD Module Table 100

9-5 Information Module Definitions 101
9-5-1 Common Patient Entity Modules 101

9-5-2 Common Study Entity Modules 101
9-5-3 Common Series Entity Modules 102
9-5-4 Frame of Reference Entity Modules 105
9-5-5 Common Equipment Entity Modules 105
9-5-6 Common Image Entity Modules 106

9-6 Private Data Dictionary 120

9-7 Mammography View Codes 121

9-8 Limitations Summary 122

10 BREAST TOMOSYNTHESIS IMAGE INFORMATION OBJECT IMPLEMENTATION 123

10-1 Introduction 123

10-2 Breast Tomosynthesis IOD Implementation 123

10-3 Breast Tomosynthesis Entity-Relationship Model 123
10-3-1 Entity Descriptions 124
10-3-2 Senographe Pristina Acquisition Workstation Mapping of DICOM entities 125

10-4 IOD Module Table 125

10-5 Breast Tomosynthesis Image Functional Group Macros 126

10-6 Information Module Definitions 126
10-6-1 Common Series Entity Modules 126
10-6-2 Common Equipment Entity Modules 127
10-6-3 Common Image Entity Modules 127
10-6-4 Application Module (Private Module) 134

10-7 Private Data Dictionary 136

10-8 Limitations summary 136

11 COMPUTED TOMOGRAPHY IMAGE INFORMATION OBJECT IMPLEMENTATION 137

11-1 Introduction 137

11-2 Computed Tomography IOD Implementation 137

11-3 Computed Tomography Entity-Relationship Model 137
11-3-1 Entity Descriptions 138
11-3-2 Senographe Pristina Acquisition Workstation Mapping of DICOM entities 138

11-4 IOD Module Table 139

11-5 Information Module Definitions 139
11-5-1 Common Image Entity Modules 140
11-5-2 Standard Extended attributes 142
11-5-3 Application Module (Private Module) 143

11-6 Private Data Dictionary 144

11-7 Limitations summary 144

12 X-RAY RADIATION DOSE STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION 145

12-1 Introduction 145

12-2 IOD Module Table 145

12-3 Information Module Definitions 145

12-3-1 Series Entity Modules 145

12-3-2 Equipment Entity Modules 146

12-3-3 Document Entity Modules 146

13 REVISION HISTORY 151

1 Introduction

1-1 Overview

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 ***Introduction on page 9*** which describes the overall structure, intent, and references for this Conformance Statement

Section 2 ***Network Conformance Statement on page 16*****,** which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

Section 3 ***Media Storage Conformance Statement on page 59*****,** which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Media Storage features.

Section 4 ***Modality Worklist Query Implementation on page 65*****,** which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

Section ***5 Modality Performed Procedure Step Implementation on page 82*****,** which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Modality Performed Procedure Step service.

Section 6 Storage Commitment Push Model implementation ***on page 87*****,** which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Storage Commitment service.

Section 7 ***Basic DICOM Directory Information Object Implementation on page 89*****,** which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Basic Directory storage service.

Section 8 ***PRINT Management Implementation on page 94*****,** which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Print management service.

Section 9 ***Digital Mammography X-ray Information Object Implementation on page 98*****,** which specifies the GE equipment compliance to DICOM requirements for the implementation of a Digital Mammography X-ray Information Object Implementation feature.

Section 10 ***Breast Tomosynthesis Image Information Object Implementation on page 123*****,** which specifies the GE equipment compliance to DICOM requirements for the implementation of Breast Tomosynthesis Image Information Object Implementation feature.

Section 11 ***Computed Tomography Image Information Object Implementation on page 137*****,** which specifies the GE equipment compliance to DICOM requirements for the implementation of Computed Tomography Image Information Object Implementation feature.

Section 12 ***X-Ray Radiation Dose Structured Report Information Object Implementation on page 145***, which specifies the GE equipment compliance to DICOM requirements for the implementation of X-Ray Radiation Dose Structure Report Information Object Implementation feature.

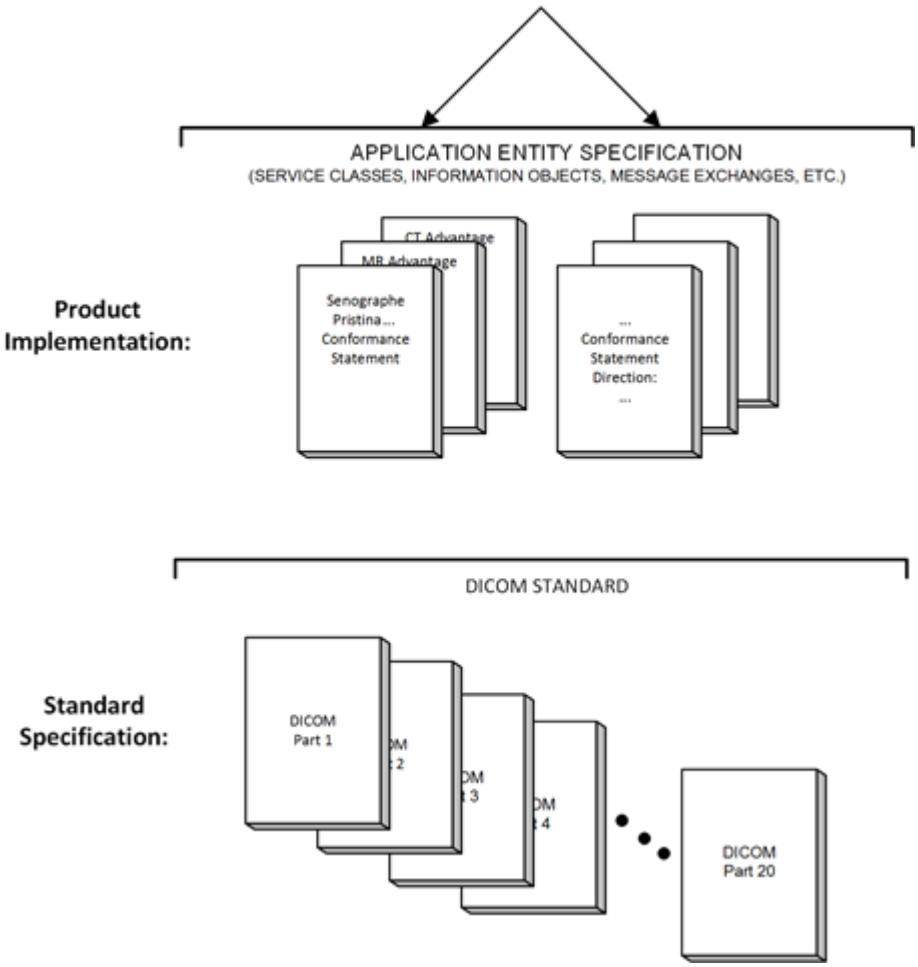
1-2 Overall DICOM Conformance Statement Document Structure

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.

GEHC DICOM Conformance Statements

@

http://www3.gehealthcare.com/en/products/interoperability/dicom



This document specifies the DICOM implementation. It is entitled:

Senographe Pristina
Senographe Pristina 3D
SenoBright HD
Pristina Serena
Pristina Serena 3D
Pristina SerenaBright
DICOM Conformance Statement

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

The GEHC Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 900
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1-3 Intended Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1-4 Scope and Field of Application

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

1-5 Important Remarks

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful**. The **user (or user's agent)** needs to proceed with caution and address at least 4 issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user**

should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1-6 References

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

1-7 Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitons of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Examples: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific X-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of 4 digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1-8 Symbols and Abbreviations

AE	Application Entity
AET	Application Entity Title
CD-R	Compact Disk Recordable
CESM	Contrast Enhanced Spectral Mammography
CR	Computed Radiography
CT	Computed Tomography
DBT	Digital Breast Tomosynthesis
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
DX	Digital X-ray
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LUT	Look-up Table
MG	Mammography (X-ray)
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MWL	Modality Worklist
NTP	Network Time Protocol
O	Optional (Key Attribute)

PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDI	Portable Data for Imaging
PDU	Protocol Data Unit
R	Required (Key Attribute)
RIS	Radiology Information System
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UI	User Interface
UID	Unique Identifier
VR	Value Representation
USB	Universal Serial Bus

2 Network Conformance Statement

2-1 Introduction

This section of the DICOM Conformance Statement specifies the Senographe Pristina compliance to DICOM requirements for **Networking** features.

This product uses healthcare industry standard DICOM 3.0 protocol to exchange information with other DICOM complaint device on the network.

2-2 Implementation Model

2-2-1 Application Data Flow Diagram

The network application model for the Senographe Pristina is shown in the following figure:

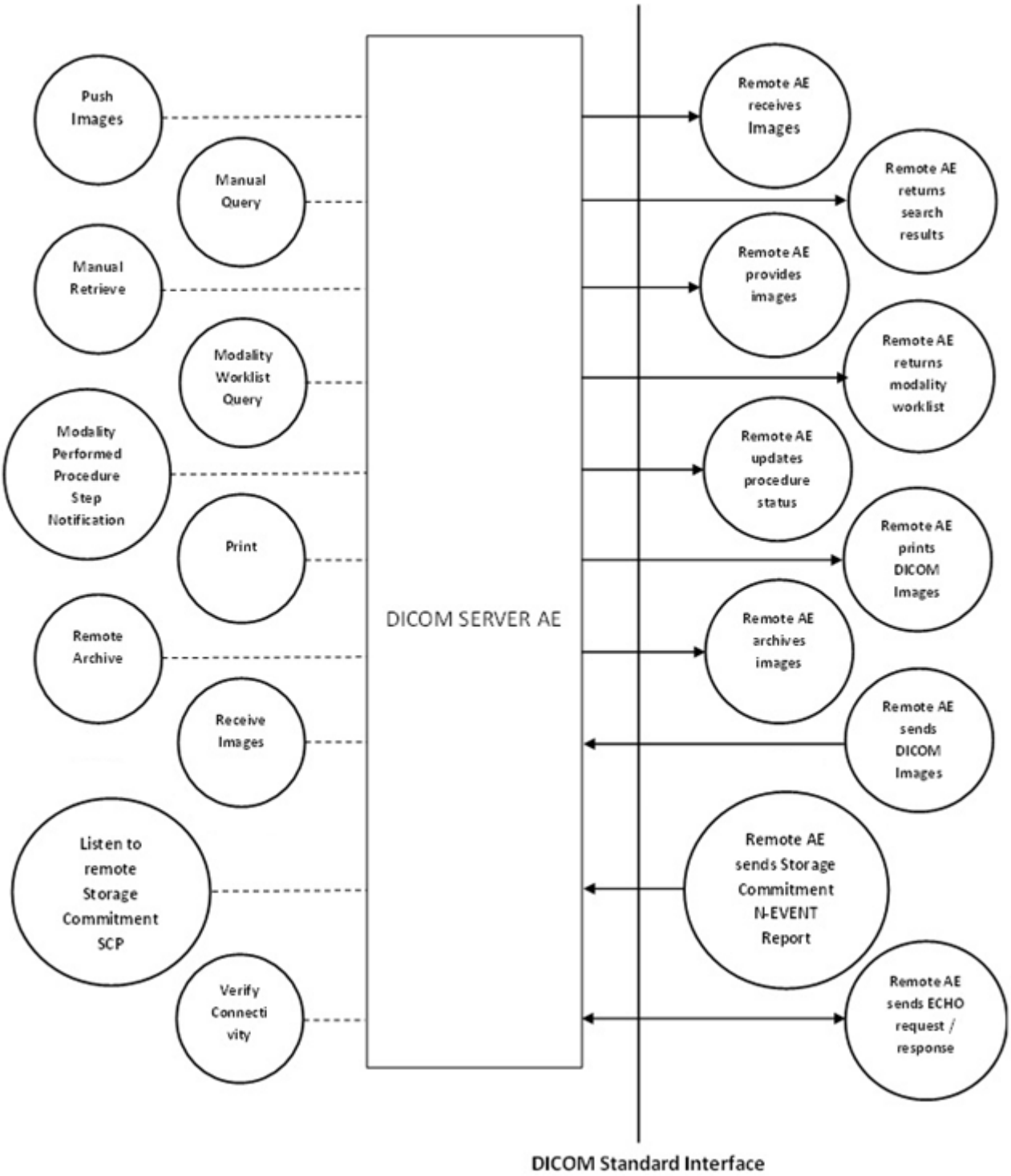


FIGURE 1 – SENOGRAPHE PRISTINA NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM

NOTE: The DICOM SERVER AE accepts also the DICOM Verification SOP class as a SCP. It is not indicated on the illustration above. The DICOM SERVER Application Entity (AE) is an application that handles DICOM protocol communication. The DICOM SERVER AE is automatically brought up when the Senographe Pristina is initialized.

The DICOM SERVER AE is invoked by the following Real World Activities:

- Push Images

For this operation, the user selects some studies, series or images on the browser and then sends the selected studies, series or images to one or several remote DICOM AE.

The transfer activity is displayed on a specific icon.

The declaration of remote DICOM AE is done through a configuration tool.

Push of images can also be automatic. This can be configured in Image preference.

- Manual Query

For this operation, the user queries one or a set of remote DICOM databases to obtain a list of data at Study/Series/Image level by clicking on the icon that represents the wanted remote DICOM AE.

- Manual Retrieve

Once the remote browser has displayed (Manual Query) query results, the user can retrieve the study/series/images from the remote DICOM AE. However, this cannot be applied for Breast tomosynthesis images.

- Receive images

When remote DICOM hosts sends DICOM images to DICOM SERVER AE , images are stored in the local database, the browser displays the content of the local database. However, this cannot be applied for Breast tomosynthesis images.

- Remote Archive

For this operation, the user selects some studies, series or images on the browser and sends them to the wanted remote DICOM AE. This initiates the DICOM push of the selected exam/series/images to the remote AE. After the successful storage of the selected exam/series/images on the remote AE, a storage commitment request is sent to the remote DICOM AE. The transfer/storage commit activity is displayed in the job management queue.

The declaration of remote DICOM AE with archiving support is done through the configuration tool.

Push of images can also be automatic. This can be configured in Image preference. After every successful storage of the automatic pushed exam/series/images to the remote AE, a storage commitment request is sent to the remode DICOM AE and the storage commit activity is displayed in the job management queue.

- Listen to remote Storage Commitment SCP

The DICOM SERVER AE is indefinitely listening for association requests. No user action is required to receive a Storage Commitment notification (N-EVENT-REPORT).

- Verify Connectivity

The user can choose to verify a remote Application Entity. Upon user's request, DICOM SERVER AE sends out a verification request to a Remote AE.

The DICOM SERVER AE also acts as an SCP for incoming Verification requests. No user action is required to process Verification requests from Remote AEs.

- Modality Worklist Query

The user or the system initiates a modality worklist query to the modality worklist SCP with a given set of query parameters. The worklist query can be manual or automatic. The modality worklist SCP returns responses matching the query parameters. Worklist items from the returned worklist query responses are presented to the user. The user then chooses the desired worklist item and begins the image acquisition process.

- Modality Performed Procedure Step Notification

When the user begins the image acquisition process and generates the first image, the DICOM SERVER AE sends a N-CREATE message to the configured MPPS SCP to indicate that the image acquisition process has been started for the requested procedure.

The user can close the acquisition session either by completing the acquisition process or discontinuing the ongoing procedure. On closing the acquisition session, the DICOM SERVER AE sends N-SET message to the configured MPPS SCP to indicate the acquisition state of the requested procedure, with appropriate MPPS status (COMPLETED/DISCONTINUED).

- Print

The Film composer allows the user to select printers. Direct print from the viewer is also supported. When user presses the "Print" Button, the DICOM SERVER AE tries to establish the association with requested printer and sends the images for printing. It is possible to set the print in an automatic mode. DBT volume cannot be printed.

2-2-2 Functional Definition of AE's

DICOM SERVER AE can receive and initiate DICOM association requests. It is automatically started as part of Senographe Pristina application startup.

Once started, the DICOM SERVER AE will wait for other DICOM applications to connect to its DICOM services.

Client applications on Senographe Pristina also have the ability to initiate DICOM associations to remote DICOM devices for Verification, Storage, Storage Commitment request, Print, Query/Retrieve, Modality Worklist Query and MPPS services through DICOM SERVER AE.

2-3 AE Specifications

2-3-1 DICOM SERVER AE Specification

DICOM SERVER Application Entity provides Standard or Standard Extended Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

TABLE 3 – SUPPORTED SOP CLASSES

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	Yes
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	Yes
Breast Tomosynthesis Image Storage [3D only]	1.2.840.10008.5.1.4.1.1.13.1.3	Yes	No
Computed Tomography Image Storage [3D only]	1.2.840.10008.5.1.4.1.1.2	Yes	No
Secondary Capture Image Storage*	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
X-Ray Radiation Dose Structured Report Information Storage	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes
Basic Grayscale Print Management Meta SOP Class**	1.2.840.10008.5.1.1.9	Yes	No
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Modality Worklist Information Model -– FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step SOP Class**	1.2.840.10008.3.1.2.3.3	Yes	No
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Yes	No
Printer SOP Class	1.2.840.10008.5.1.1.16	Yes	No

NOTE: [3D only] Only for Senographe Pristina 3D and Pristina Serena 3D
* can be received and pushed but not generated.
** Not applicable for 2D Biopsy and 3D biopsy.

2-3-1-1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name, which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DICOM SERVER AE is:

Maximum Length PDU	64KB

2.3.1.1.2 Number of Associations

The DICOM SERVER AE will initiate a maximum of 2 simultaneous associations to remote nodes.

The DICOM SERVER AE will support a maximum of 4 simultaneous associations initiated by remote nodes.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

Implementation UID	1.2.826.0.1.3680043.2.60.0.1 for 2D images 1.2.840.113619.6.324 for volumes
Implementation Version Name	NUEVO_1_0 for 2D images MergeCOM3_5_1_0 for volumes

2-3-1-2 **Association Initiation Policy**

When the DICOM SERVER Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The DICOM SERVER AE proposes all supported Transfer Syntaxes in a single Presentation Context for a given Abstract Syntax. i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context with all Transfer Syntaxes supported for that Abstract Syntax.

Except for systems with DBT option, where the DICOM SERVER AE proposes all supported Transfer Syntaxes on separate negotiations.

2.3.1.2.1 Real-World Activity: Push Images

2.3.1.2.1.1 Associated Real-World Activity

The user first selects the exam/series/image on the local database browser and clicks on the Remote DICOM AE to which the user desires to send the exam/series/image to.

If multiple exams/series are chosen to be pushed, one association will be established for each of the exam/series. A single association will be used for multiple C-STORE operations necessary for the images in an individual series for 2D. For 3D, there are multiple separate associations.

2.3.1.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the DICOM SERVER AE after Real-World Activity "*Push Images*" operation has been performed:

TABLE 4 - PRESENTATION CONTEXT – PROPOSED BY DICOM SERVER AE FOR ACTIVITY *PUSH IMAGES*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Secondary Capture Image Storage*	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Breast Tomosynthesis Image Storage [3D only]	1.2.840.10008.5.1.4.1.1.13.1.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian Lossless JPEG Compression Lossy JPEG Compression Lossless JPEG-LS Compression Lossless JPEG 2000 Compression	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.80 1.2.840.10008.1.2.4.90	SCU	None
Computed Tomography Image Storage [3D only]	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian Lossless JPEG Compression Lossless JPEG-LS Compression Lossless JPEG 2000 Compression	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.80 1.2.840.10008.1.2.4.90	SCU	None
X-Ray Radiation Dose SR Information	1.2.840.10008.5.1.4.1.1.88.67	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

NOTE: [3D only] Only for Senographe Pristina 3D and Pristina Serena 3D

*Secondary capture Image can be received or sent but the system does not generate them

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for All Storage SOP Classes

This implementation can perform multiple C-STORE operations over a single association.

Upon receiving a C-STORE confirmation containing a successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will consider the current request to be a failure and will terminate the association.

For all C-STORE statuses other than success or warnings received, this implementation will consider the current request to be a failure and will terminate the association, except if the C-STORE is invoked from a C-MOVE SCP. In this case it will continue to attempt to send the remaining images in the request on the same association. The error details will be logged in the log files.

For all C-STORE operation some timers are used:

- <u>For 2D images</u>

  Each C-STORE operation supports an “Association Timer”. This timer starts when the association request is sent and stops when the association is established. Time-out is 60 seconds.

  Each C-STORE operation supports an “Operation Inactivity Timer”. This timer starts when a C-STORE request is emitted and is reset each time a C-STORE response has been received, or when subsequent C-STORE are received. Time-out is 300 seconds.

  If any of the 2 timers mentioned above expires, the connection is aborted and the operation is considered as failed.

- <u>For 3D volumes</u>

  For all C-STORE operation of 3D volumes following timers are used:

  - Network connection timeout: Timeout waiting for the establishment of the TCP/IP connection. Default value: 15 seconds.

- Association reply timeout: timeout waiting for the association accept message from the remote host, after recon has sent the association request message. Default value: 30 seconds.
- Message read timeout: timeout waiting for the C-STORE response from the remote host. Default value: 15 seconds.
- Association release timeout: timeout waiting for the association release accept message from the remote host, after recon has sent the association release request message. Default value: 15 seconds.

The default value of each of those timer for 3D volumes can be configured.

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment:

TABLE 5 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR ACTIVITY PUSH IMAGES

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700-A7FF	Refused: Out of resources	Operation considered as failed. Error displayed in the Network status and browser job manager queue. Log-files updated. A701/A702/A7: push job is retried
	A900-A9FF	Error: Data Set does not match SOP Class	Operation considered as failed. Error displayed in the Network status and browser job manager queue. Log-files updated. Push job is not retried
	C000-CFFF	Error: Cannot Understand	Operation considered as failed. Error displayed in the Network status and browser job manager queue. Log-files updated. Push job is not retried
	0110	Error: Processing Failure	Operation considered as failed. Error displayed in the Network status and browser job manager queue. Log-files updated. Push job is not retried
Warning	B000	Coercion of Data Elements	Operation considered as successful. Warning is logged in the log files.
	B006	Elements Discarded	Operation considered as successful. Warning is logged in the log files.
	B007	Data Set does not match SOP Class	Operation considered as successful. Warning is logged in the log files.
Success	0000		Success status displayed in the Network status and browser job manager queue. Log files updated.
*	*	Any other status code.	Operation considered as failed. Error displayed in the Network status and browser job manager queue. Log-files updated.

2.3.1.2.2 Real-World Activity: Manual Query

2.3.1.2.2.1 Associated Real-World Activity

The user queries a Remote database by clicking on the corresponding icon on the Senographe Pristina browser source dropdown.

The *"Query"* operation will cause a "*Filter Data"* menu to appear. The user can enter values for Patient name, Patient Id, Study Id, Accession number, Study date and Modality. Not entering a value will result in universal match for that field (all possible values). For Study date, the user selects a date matching type from the "Exam date" pull down menu, where the choices are Today, This Week, 30 days, Date Range. If the user selects Date Range, the menu will allow entering a start date and an end date. Once the desired parameters are entered, the user chooses "*Search*".

The *"Query"* operation will cause the DICOM SERVER AE to initiate an association to the selected Remote AE.

On successful query, the list of corresponding study is displayed.

The user can also get the detailed content of one or several study displayed by selecting it, the DICOM SERVER AE to initiate an association to the selected Remote AE with the Study Instance UID as a matching key (same at series level with Series Instance UID).

The "Filter" menu contains a "Clear" button. If the user selects it, it will empty all the field in the menu and will cause the DICOM SERVER AE to initiate an association to the selected Remote AE, without any matching key.

The user can invoke the *"Retrieve"* operation from the displayed results.

2.3.1.2.2.2 Proposed Presentation Context Table

When the remote DICOM AE is declared as a Query/Retrieve SCP and the invoked operation is "Query", the presentation context shown in the following table is proposed:

TABLE 6 - PRESENTATION CONTEXT– PROPOSED BY DICOM SERVER AE FOR ACTIVITY *MANUAL QUERY*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

NOTE: When the Real-World activity *"Manual Query"* is initiated, all presentation contexts specified in the above table are proposed during association establishment, but only the Query/Retrieve-FIND related context is applicable to this activity.

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - FIND SOP Classes

The C-FIND SCU will only perform hierarchical query (No extended negotiation supported).

The Study level query will request for studies in the remote database that match the user specified Patient name, Modality, Patient ID, Study date and Accession number. Zero length data in any of the field means match on any value. Zero length data is the default value if the user does not specify a value, except for Modality where default value is "MG".

Here is the list of the supported matching types in addition to Universal Matching:

Type of matching	Description
Single Value Matching	This is to obtain an exact match on the value contained in a Key Attribute.

Type of matching	Description
Wild Card Matching	This is to obtain a match on any sequence of characters contained in a Key Attribute. "*" or "?" characters present in the Key Attribute, where "*" shall match any sequence of characters and "?" matches against a single character.
Range Matching	This is to obtain a match on values of date and time contained in the Key Attributes: "<date1> - <date2>" to match against all values that fall in this date range. "-<date>" to match against all values that are before this date. "<date> -" to match against all values that are after this date.

- Details for patient name matching

The user can specify patient name search criteria to be an exact match or a wild card match. Wild card searches are specified using asterisk (*). Below samples demonstrate some of the search patterns.

"" – represents all patient names

"*" – represents all patient names

"*m" – represents all patient names ending with character 'm'

"m*" – represents all patient names beginning with character 'm'

"*m*" – represents all patient names containing character 'm'

"m" – represents all patients whose name is 'm' exactly

DICOM Patient name structure is as follows: LastName^FirstName^MiddleName^Prefix^Suffix.

If the user wants to do a match query on Last name and first name, for example, s/he will need to add carets.

Example:

M*^John: To search for all John with Last Name starting by "M"

The user can combine the above described patterns to form desired filter conditions.

- Details for study date matching

The Study date search criteria is specified using below formats:

"" represents any date,

"yyyymmdd-" represents any date on or after that year/month/day,

"-yyyymmdd" represents any date on or before that year/month/day,

"yyyymmdd-yyyymmdd" represents any date on or between those dates,

"yyyymmdd" represents the exact date.

The DICOM SERVER AE will parse each matching C-FIND-RSP reply and will abort the association if an entry does not contain a valid dataset.

Each C-FIND SCU operation supports an "Association Timer" and "Operation Inactivity Timer" using QueryAssociationTimeout (30 seconds) and QueryResponseTimeout (5 minutes).

The user can cancel the current C-FIND request by initiating *Query* activity to another network node or clicking on the local database. If a query operation is in progress, the DICOM SERVER AE will issue a C-FIND-CANCEL message to the remote AE to discontinue the ongoing C-FIND operation.

If a “Failure” status is returned from the Remote AE, the association is closed and the operation terminated.

Table 7, Table 8 and Table 9 show the various fields that are requested at the Study, Series, and Image levels of the C-FIND request.

NOTE: In the following Tables, the *Type* field has the following meanings:

R - Required

U - Unique

O - Optional

TABLE 7 - REQUESTED STUDY LEVEL KEYS

Description	Tag	Type	Value
Study Date	(0008,0020)	R	Study dates (supported filter: single value matching, range matching)
Study Time	(0008,0030)	R	Zero length
Accession Number	(0008,0050)	R	Accession Number (supported filter: single value matching, wild card matching)
Patient’s Name	(0010,0010)	R	Patient Name (Supported filter: single value matching, wild card matching). See above for more details.
Patient ID	(0010,0020)	R	Patient ID (supported filter: single value matching, wild card matching)
Study ID	(0020,0010)	R	Study ID (supported filter: single value matching, wild card matching)
Study Instance UID	(0020,000D)	U	Zero length for Study level query. Study Instance UID of study for which matches are requested at a lower level
Modalities in Study	(0008,0061)	O	Zero length
Station Name	(0008,1010)	O	Zero length
Study Description	(0008,1030)	O	Zero length
Patient’s Birth Date	(0010,0030)	O	Zero length
Patient’s Sex	(0010,0040)	O	Zero length
Patient’s Birth Time	(0010,0032)	O	Zero length
Number of Study Related Instances	(0020,1208)	O	Zero length
SpecificCharacterSet	(0008,0005)	O	See *2-7 Support of Extended Character Sets*. Default value is ISO IR_192.

The following table shows the various fields that are requested at the Series level of the C-FIND request:

TABLE 8 - REQUESTED SERIES LEVEL KEYS

Description	Tag	Type	Value
Series Number	(0008,0011)	R	Zero length.
Modality	(0008,0060)	R	Zero length.
Series Instance UID	(0020,000E)	U	Zero length for Series level query. Series instance UID of series for which matches are requested at a lower level.
Series Description	(0008,103E)	O	Zero length.
Series Date	(0008,0021)	O	Zero length.
Series Time	(0008,0031)	O	Zero length.
Series Type	(0054,1000)	O	Zero length.
Manufacturer	(0008,0070)	O	Zero length.
Number Of Series Related Instances	(0020,1209)	O	Zero length.
RequestedAttributesSequence	(0040,0275)	O	Zero length.

Description	Tag	Type	Value
ScheduledProcedureStepDescription	(0040,0007)	3	Zero length.
StudyInstanceUID	(0020,000D)	U	Study Instance UID of study for which matches are requested.
Image type (for legacy systems)	(0008,0008)	O	Zero length.
SpecificCharacterSet	(0008,0005)	O	See *2-7 Support of Extended Character Sets*, will use the character set of current study.

The following table shows the various fields that are requested at the Image level of the C-FIND request. The list of requested fields depends on the value returned for the Modality (0008,0060) in the C-FIND-RSP response at series level given by the remote AE.

TABLE 9 - REQUESTED IMAGE LEVEL KEYS

Description	Tag	Type	Value	Modality
Instance Number	(0020,0013)	R	Zero length	All
SOP Instance UID	(0008,0018)	U	Zero length	All
Image Type	(0008,0008)	O	Zero length	All
Acquisition Time	(0008,0032)	O	Zero length	All
Modality	(0008,0060)	O	Zero length	All
Contrast / Bolus Agent	(0018,0010)	O	Zero length	All
Slice Thickness	(0018,0050)	O	Zero length	All
Repetition Time	(0018,0080)	O	Zero length	All
Echo Time	(0018,0081)	O	Zero length	All
Inversion Time	(0018,0082)	O	Zero length	All
Number Of Averages	(0018,0083)	O	Zero length	All
Echo Number	(0018,0086)	O	Zero length	All
Spacing Between Slices	(0018,0088)	O	Zero length	All
Data Collection Diameter	(0018,0090)	O	Zero length	All
Trigger Time	(0018,1060)	O	Zero length	All
Reconstruction Diameter	(0018,1100)	O	Zero length	All
Gantry / Detector Tilt	(0018,1120)	O	Zero length	All
Convolution Kernel	(0018,1210)	O	Zero length	All
Flip Angle	(0018,1314)	O	Zero length	All
Image Position (Patient)	(0020,0032)	O	Zero length	All
Image Orientation (Patient)	(0020,0037)	O	Zero length	All
Slice Location	(0020,1041)	O	Zero length	All
Rows	(0028,0010)	O	Zero length	All
Columns	(0028,0011)	O	Zero length	All
Pixel Spacing	(0028,0030)	O	Zero length	All
Units	(0054,1001)	O	Zero length	All
Reconstruction Method	(0054,1103)	O	Zero length	All
Image ID	(0054,0400)	O	Zero length	All
SpecificCharacterSet	(0008,0005)	O	See *2-7 Support of Extended Character Sets*, will use the character set of current series.	All
DetectorSecondaryAngle	(0018,1531)	O	Zero length	All
StudyInstanceUID	(0020,000D)	O	Study Instance UID of study for which matches are requested.	All
SeriesInstanceUID	(0020,000E)	O	Series Instance UID of study for which matches are requested.	All

During the C-FIND, the following pending status values are supported:

- 0xFF00: Study/Series/Image items contained in identifier are collected for later display or further processing and wait for the next response from the remote host.
- 0xFF01: Study/Series/Image items contained in identifier are collected for later display or further processing and wait for the next response from the remote host.

Following are the status codes that are more specifically processed when receiving messages from a **Query** SCP equipment:

TABLE 10 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR ACTIVITY *MANUAL QUERY*

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources.	Browser displays appropriate error to user.
	A900	Error: Identifier does not match SOP Class.	Browser displays appropriate error to user.
	C000-CFFF	Error: Unable to process.	Browser displays appropriate error to user.
Cancel	FE00	Matching terminated due to cancel.	1. Considered as invalid status and the operation is terminated if the query CANCEL was not requested. 2. If the query CANCEL was requested by the SCU, then system gracefully exits the C-FIND request processing.
Success	0000	Matching is complete - No final identifier is supplied.	Processed and gracefully exits the C-FIND request processing.
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Processed and the data is displayed in the Browser.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.	Processed and the data is displayed in the Browser.
*	*	Any other status code.	Operation terminated and the association is closed. Browser displays appropriate error to user.

2.3.1.2.3 Real-World Activity: Manual Retrieve

2.3.1.2.3.1 Associated Real-World Activity

The user has to perform the Real-World activity “Query” to get a list of Studies, Series and Images. Once the list of Studies, Series or Images is displayed, the user can invoke the “Retrieve” operation from the displayed results (select exam/series/images from the results and click on local database button on the Browser).

2.3.1.2.3.2 Proposed Presentation Context Table

When the remote DICOM AE is declared as a Query/Retrieve SCP and the invoked operation is “retrieve”, the presentation context shown in following table is proposed.

TABLE 11 - PRESENTATION CONTEXT – PROPOSED BY DICOM SERVER AE FOR ACTIVITY *MANUAL RETRIEVE*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

NOTE: When a Real-World activity "Manual Retrieve" is initiated, all presentation contexts specified in the above table are proposed during association establishment, but only the Query/Retrieve-MOVE related context is applicable to this activity.

2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - MOVE SOP Classes

When the user initiates a *Move* operation at any level (Study, Series, Image) the DICOM SERVER AE will initiate a C-MOVE-RQ request to the Remote AE with the DICOM SERVER AE as the Destination AE. The Storage SCP (refer section *2.3.1.3.1 Real-World Activity: Receive Images*) will handle the incoming images.

Each C-MOVE SCU supports an "Association Timer" and an "Operation Inactivity Timer". These timers are set to 60 and 300 seconds respectively.

The C-MOVE SCU supports only the Baseline behavior and does not negotiate for Extended behavior during association. During the move operations, Unique Key values for all levels above the Query/Retrieve Level specified will be supplied in the C-MOVE request.

The DICOM SERVER AE does not send a C-MOVE request with List of UIDs. If the user chooses multiple exams from the remote browser for retrieval, it creates separate association and send one C-MOVE request with single exam UID, for each study. The system works the same way when the user tries to retrieve multiple series.

An individual retrieve-job is created in the job management queue for each exam/series request.

If the user tries to retrieve multiple images within a series, it will create single association and sends multiple C-MOVE requests; one C-MOVE request per image within the same association.

However, for each user request, a single retrieve-job is created in the job management queue.

If the C-MOVE SCU receives a status different from success (0x0000) or pending (0xFF00) during the association, the DICOM SERVER AE will release the association. This information will be logged in the system log files and the network/job manager queue will be updated accordingly.

During *Manual Retrieve*, the DICOM SERVER AE is able to generate a C-MOVE-CANCEL.

When a Cancel response (0xFE00) is received, the DICOM SERVER AE will release the association. This information will be logged in the system log files and the network queue will be updated accordingly.

Following are the status codes that are more specifically processed when receiving messages from a **Retrieve** SCP equipment:

TABLE 12 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR ACTIVITY *MANUAL RETRIEVE*

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A701	Refused: Out of resources - Unable to calculate number of matches	The system will display the failure message in job manager user interface and retry the operation after time is elapsed.
	A702	Refused: Out of resources - Unable to perform sub-operations	The system will display the failure message and retry the operation after configured time is elapsed.
	A801	Refused: Move Destination Unknown	The system will display the failure message in job manager user interface.
	A900	Error: Identifier does not match SOP Class	The system will display the failure message in job manager user interface.
	C000-CFFF	Error: Unable to process	The system will display the failure message in job manager user interface.
Cancel	FE00	Sub-operations terminated due to a Cancel indication	1. Considered as invalid status and the operation is terminated if the Move CANCEL was not requested. 2. If the Move CANCEL was requested by the SCU, then the system gracefully exits the C-MOVE request processing.
Warning	B000	Sub-operations Complete - One or more Failures.	The system will display the failure message in the job manager user interface.
Success	0000	Sub-operations Complete - No Failure.	Processed and gracefully exits C-MOVE request processing.
Pending	FF00	Sub-operations are continuing.	The system processes the information and displays the progress in the job manager UI.
*	*	Any other status code.	C-MOVE operation is considered as failure. The system will display the failure message in the job manager user interface and log the information in the log files.

2.3.1.2.4 Real-World Activity: Remote Archive

2.3.1.2.4.1 Associated Real-World Activity

1. If the remote host was declared on the system along with an associated Storage Commitment Provider:
   - from the browser, the user selects the instances to be archived to the remote host.
   - or, instances are auto-pushed to the remote host.

Then, if images are successfully sent, then the N-ACTION-RQ request is sent to Storage Commitment Provider in a new association.

(Remote host and storage commitment provider may have different configurations).

2. The system waits for N-ACTION-RSP from Storage Commitment Provider. N-ACTION is on different association than the C-STORE request.
3. On reception of failure in N-ACTION-RSP, the corresponding job has a failed status in the job management queue.
4. On reception of success, Storage Commitment AE is ready to receive at any time from Storage Commitment Provider the N-EVENT-REPORT-RQ notification. N-EVENT-REPORT can be in the same association than the N-ACTION or in a new one.

5. On reception of the N-EVENT-REPORT-RQ notification from Storage Commitment Provider, system flags the images in the database as committed.

6. When all images are flagged, Storage Commitment AE sends a N-EVENT-REPORT-RSP to the Storage Commitment Provider.

NOTE: The table in section *2.3.1.2.1.2 Proposed Presentation Context Table* has the full list of SOP Classes that can be Storage Committed.

2.3.1.2.4.2 Proposed Presentation Context

TABLE 13 - PRESENTATION CONTEXT– PROPOSED BY DICOM SERVER AE FOR ACTIVITY *REMOTE ARCHIVE*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.4.2.1 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU (N-ACTION)

The DICOM SERVER AE may request Storage Commitment for Instances of any of the Composite SOP Classes it supports as an SCU (see Section *2.3.1.2.1.2 Proposed Presentation Context Table*).

The DICOM SERVER AE uses DICOM network storage services to transfer SOP Instances which are to be committed. If there are any failures in the image transfers, the Storage commitment request will not be sent. The corresponding job will be marked as failed and user will be notified of the status of job.

If all the images are successfully transferred, then the commitment (N_ACTION) request will be sent on a different association with the list of SOP instances.

If the N_ACTION request fails, the job will be marked as failed; otherwise, the following sequence of actions will take place:

The SCU waits for N_ACTION response from the provider on the same association. Time-out is 600 seconds. If it does not receive N_ACTION response during this time it closes the association and marks the job as failed.

If the received N-ACTION Response from the Storage Commitment Provider has a success status, the DICOM SERVER AE waits 10 seconds for an N-EVENT-REPORT on the same association. This time-out is not configurable. If the N-EVENT-REPORT request is not received in this time, it closes the association and changes the Job state to ”Waiting” indicating the job is waiting for the response from commitment provider.

The DICOM SERVER AE can receive a N-EVENT-REPORT from the Storage Commitment Provider at any time (See section *2.3.1.3.4 Real-World Activity: Listen to remote Storage Commitment SCP*).

A new Transaction UID will be created for each retry by the user. The old Transaction UID is not applicable for these requests.

Following are the status codes that are more specifically processed when receiving N-Action responses from a **Storage Commitment** SCP equipment:

TABLE 14 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR ACTIVITY *REMOTE ARCHIVE*

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	0119	Class-instance conflict	The system displays the appropriate error message in the job manager user interface.

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
	0115	Invalid argument value	The system displays the appropriate error message in the job manager user interface.
	0117	Invalid SOP Instance	The system displays the appropriate error message in the job manager user interface.
	0212	Mistyped argument	The system displays the appropriate error message in the job manager user interface.
	0114	No such argument	The system displays the appropriate error message in the job manager user interface.
	0118	No such SOP Class	The system displays the appropriate error message in the job manager user interface.
	0110	Processing failure	The system displays the appropriate error message in the job manager user interface.
	0213	Resource limitation	The system logs the appropriate error message and retries the operation after the configured time is elapsed.
	0211	Unrecognized operation	The system displays the appropriate error message in the job manager user interface.
Success	0000		The request for storage comment is considered successfully sent. System displays "waiting" message in the job manager user interface.
*	*	Any other status code.	The system displays the appropriate error message in the job manager user interface.

If a Storage Commitment N-EVENT-REPORT is received on the Association initiated by this Application Entity, it will be processed as described for Association initiated by the Storage Commitment SCP (see Section *2.3.1.3.4 Real-World Activity: Listen to remote Storage Commitment SCP*).

2.3.1.2.5 Real-World Activity: Verify Connectivity

2.3.1.2.5.1 Associated Real-World Activity

The user can choose to verify a remote Application Entity. Upon user's request, DICOM SERVER AE sends out a verification request to a Remote AE.

2.3.1.2.5.2 Proposed Presentation Context

TABLE 15 - PRESENTATION CONTEXT– PROPOSED BY DICOM SERVER AE FOR ACTIVITY *VERIFY CONNECTIVITY*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.5.2.1 SOP Specific DICOM Conformance Statement for Verification SOP class

The DICOM SERVER AE provides standard conformance. In case of failure, the verification is not retried.

Each C-ECHO operation supports an "Association Timer". This timer starts when the association request is sent and stops when the association is established. Time-out is 20 seconds. If the remote AE does not respond with the association time-out, the verification operation is considered as failed.

2.3.1.2.6 Real-World Activity: Modality Worklist Query

2.3.1.2.6.1 Associated Real-World Activity

The user of the system initiates a query for a modality worklist by pressing the Refresh button or by using the HISRIS Search menu. The refresh can also be automatic and the time between 2 refreshes is configurable. The DICOM SERVER AE will then initiate an association with the remote AE in order to query for the worklist. The association is closed upon receipt of the final query response from the remote AE. The association can also be closed by the DICOM SERVER AE upon receipt of error status from the remote AE or upon expiration of association timers.

A user can configure a number of parameters, which directly control the worklist query request. The user can request worklist items that are intended for the scanner the user is working at, all items that apply to the modality type of the scanner the user is working at or all worklist items available. These selections and their effects on worklist query parameters are given below:

This System:

Modality, (0008,0060) - set to MG.

Scheduled Station AE Title, (0040,0001) - set to Station name AE title.

This Modality:

Modality, (0008,0060) - set to MG.

Scheduled Station AE Title, (0040,0001) - zero-length (universal matching).

Or user can fill in the “AE Title” field with another system AET (single value Matching).

This allows getting the worklist items that was planned for another system.

All Modalites:

Modality, (0008,0060) – zero-length (universal matching).

Scheduled Station AE Title, (0040,0001) - zero-length (universal matching).

The scheduled dates of procedures of interest can be specified for query by selecting a specific date range. The choices are Any Day, Today, Today and number of days before, Today and a number of days after, Date Range. These selections and their effects on worklist query parameters are given below:

Today:

Scheduled Procedure Step Start Date, (0040,0002) - set to YYYYMMDD, where this date is the current date.

Today and number of days before:

The user can configure the number of days before Scheduled Procedure Step Start Date, (0040,0002) - set to (YYYYMMDD-nd)-YYYYMMDD, where YYYYMMDD is the current date, nd is the number of days before and YYYYMMDD-nd is nd days before current date.

Today and number of days after:

The user can configure the number of days after Scheduled Procedure Step Start Date, (0040,0002) - set to YYYYMMDD-(YYYYMMDD+nd), where YYYYMMDD is the current date, nd is the number of days after and YYYYMMDD+nd is nd days after current date.

Date Range:

Scheduled Procedure Step Start Date, (0040,0002) - set to YYYYMMDD-YYYYMMDD, where both dates are those configured by user.

Any Day:
Scheduled Procedure Step Start Date, (0040,0002) - zero-length (universal matching).

Note that selecting All Modalities and All Days with no worklist specific fields specified results is an unconstrained worklist query. The response to an unconstrained worklist query can differs between different modality worklist SCP implementations. Consult the modality worklist SCP manufacturer if difficulties occur when attempting unconstrained queries.

Worklist specific fields targeted to retrieve a single or very small set of related entries may also be specified. These fields may be used for a query combined with scanner and scheduled time to provide a very specific query to the worklist server. The specific fields are specified below:

Patient Name (0010,0010)

Matching with leading and trailing wildcards is allowed on either Patient Last Name or Patient First Name (user selectable), zero length matches all values.

Details for patient name matching

User can specify patient name search criteria to be an exact match or a wild card match. Wild card searches are specified using asterisk (*). Below samples demonstrate some of the search patterns:

“” – represents all patient names.

“*” – represents all patient names.

“*m” – represents all patient names ending with character ‘m’.

“m*” – represents all patient names beginning with character ‘m’.

“*m*” – represents all patient names containing character ‘m’.

“m” – represents all patients whose name is ‘m’ exactly.

DICOM Patient name structure is as follows: LastName^FirstName^MiddleName^Prefix^Suffix.

If user wants to do a match query on Last name and first name, for example, s/he will need to add carets.

Examples:

“M*^John*”: To search for all John with Last Name starting by “M”.

"Doe^John"^^^Ph.D= = (One family name; one given name; no middle name; no prefix; one suffix; no ideographic component; no phonetic component).

The user can combine the above described patterns to form desired filter conditions.

Patient ID (0010,0020)
Zero length or single value matching only of value entered.

Requested Procedure ID (0040,1001)
Zero length if value not specified or single value matching of value if specified.

Accession Number (0008,0050)
Leading and trailing wildcard matching for value entered.

2.3.1.2.6.2 Proposed Presentation Context

The following table shows the proposed presentation contexts for the DICOM SERVER AE after real-world activity "Modality Worklist Query" has been initiated:

TABLE 16 - PRESENTATION CONTEXT– PROPOSED BY DICOM SERVER AE FOR ACTIVITY *MODALITY WORKLIST QUERY*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.6.2.1 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model FIND SOP Class

If the remote AE does not support the proposed Presentation Context, an appropriate error is logged and the user is notified.

This implementation can receive multiple C-FIND results over a single association. Only one association is opened at a time.

Each C-FIND response received from the remote AE is parsed to verify the length/type of the items in the response. Upon detecting any error in the response data, the response is discarded and the next response (if any) is considered. Refer to section *2.3.1.2.6.2.2* for more details on worklist item acceptance policy.

Each C-FIND SCU operation supports an "Association Timer" and "Operation Inactivity Timer" using QueryAssociationTimeout and QueryResponseTimeout. Values are 30 seconds, 3 minutes respectively.

In case of ERROR, persisted worklist item(s) got from previous request to the configured SCP would be shown.

User can cancel the ongoing worklist query by clicking on the Cancel button in the UI. Upon cancel, the DICOM SERVER AE will send C-FIND-CANCEL request to the Modality Worklist SCP.

Following are the status codes that are more specifically processed when receiving messages from a **Modality Worklist** SCP equipment:

TABLE 17 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR ACTIVITY *MODALITY WORKLIST QUERY*

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources.	Logs the error and displays all the persisted worklists.
	A900	Error: Identifier does not match SOP Class.	Logs the error and displays all the persisted worklists.
	C001	Error: Unable to process.	Logs the error and displays all the persisted worklists.
Cancel	FE00	Matching terminated due to cancel.	Closes the association.
Success	0000	Matching is complete - No final identifier is supplied.	Displays all the worklists items obtained from the SCP.

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Continues to wait for worklists items from SCP.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.	Continues to wait for worklists items from SCP.
*	*	Any other status code.	Worklist query operation is considered as failure and the error message is displayed to the user. Persisted worklist item(s) got from previous request to the SCP will be shown.

2.3.1.2.6.2.2 Record Acceptance Policy

The DICOM SERVER AE has a lenient policy regarding the rejection of the MWL. In case any parameters retrieved from the MWL are invalid, the system will correct automatically or require/allow the user to enter the value through the UI.

Following acceptance and correction policy is applied on the received worklist items in order to be lenient on DICOM technical violations by the remote AE:

- Trailing space in UI element value will be changed to trailing null.
- Study Instance UID will be locally generated if the Study Instance UID in the worklist item is absent or invalid (for example if it is more than 64 characters).
- Strings (SH, LO) that are VM=1 and contain \ characters will be processed for HL7v2 escape character conversion:
  - \F\ replaced by |
  - \S\ replaced by ^
  - \T\ replaced by &
  - \E\ replaced by #
  - Any other use of \ be replaced by # and the rest of the string will be truncated
- Strings (CS, SH, LO) that are too long will be truncated. Last character in each truncated value will be set to # (except for CS)
- Replaces individual <CR>, individual <LF>, <CR><LF> combination, and <LF><CR> combination with a canonical NewLine control in Text (ST, LT) . The NewLine control set is appropriate to the display environment (e.g., a single <LF> character in Unix).
- Text (ST, LT) that is too long will be truncated. Last character in each truncated value will be set to #.
- Names (PN) will be truncated at 64 characters per name component group or after the 5th caret.
- Date/Time (DA, DT, TM) that are Type 2 or 3 and are outside a valid range will be set to zero length.
- CS characters that are lower case will be set to upper case, and – changed to _.

- Any missing Type 2 attributes in the query response will be added in with zero length.
- Any invalid Type 2 attribute after the above processing will be set to zero length.
- Any invalid Type 3 attribute after the above processing will be discarded.

Worklist item that does not comply to this acceptance policy is discarded and the next response (if any) is considered.

2.3.1.2.7 Real-World Activity: Modality Performed Procedure Step Notification

The DICOM SERVER AE initiates association to the remote MPPS SCP AE for the following functions during real world activity *Modality Performed Procedure Step Notification*:

- *Start PPS*: Initiates a DICOM association in order to create a DICOM Modality Performed Procedure Step SOP instance in the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the SCU will issue a request to create the SOP instance in the remote AE via the N-CREATE service.
- *Complete PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the SCU will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'COMPLETED'.
- *Discontinue PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the SCU will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'DISCONTINUED'.

2.3.1.2.7.1 Associated Real-World Activity

The real-world activities are described in the following sections. Each of the real world activity results in either creating a new Performed Procedure Step SOP instance at the remote SCP or updating an already created Performed Procedure Step SOP instance as per the DICOM standard.

2.3.1.2.7.1.1 Sequencing of Real-World Activities

The PPS design is the same for acquisition system with and without MWL data.

Senographe Pristina will only be able to send PPS objects to one PPS SCP. It is not possible to support more PPS SCPs, because an image can reference only one PPS object.

####### *2.3.1.2.7.1.1.1 PPS from Acquisition System for 2D exam*

1. After the first image is acquired into the database, the PPS SCU (acquisition system) sends 2 PPS N-CREATE messages to the PPS SCP (PPS Manager), informing the exam has begun. The status of this PPS in IN PROGRESS. The first N-CREATE message refers to raw images and the second N-CREATE message refers to processed images.
2. At the end of the exam, the PPS SCU send 2 N-SET messages to the PPS SCP, informing the exam has finished. The status of this PPS can be COMPLETED or DICSCONTINUED based on the choice selected by the user using the interface provided. One N-SET message refers to processed images and the other on refers to raw images.

Dose information is available in the N-SET message corresponding to Raw image.

2.3.1.2.7.1.1.2 PPS from acquisition system for 3D exam (only for Senographe Pristina 3D)

1. After the first image is acquired into the database, the PPS SCU (acquisition system) sends one PPS N-CREATE messages to the PPS SCP (PPS Manager), informing the exam has begun. The status of this PPS in IN PROGRESS. The N-CREATE message refers to raw projection images.
2. At the end of the exam, the PPS SCU send one N-CREATE and 2 N-SET messages to the PPS SCP, informing the exam has finished. The status of this PPS can be COMPLETED or DICSCONTINUED based on the choice selected by the user using the interface provided. The N-CREATE message refers to the volume reconstruction, nne N-SET message refers to volumes and the other on refers to raw images.

Dose information is available in the N-SET message corresponding to 3D Raw image.

NOTE: If exam with 2D and 3D images is performed, dose information is available in the N-SET message for raw images, corresponding to the first N-Create message sent to the PPS SCU. If 2D images are acquired before 3D, dose information will be available in the N-SET corresponding to 2D RAW images. If 3D projections are acquired before 2D images, then dose information will be available in the N-SET corresponding to the 3D projections.

2.3.1.2.7.2 Proposed Presentation Context

TABLE 18 - PRESENTATION CONTEXT– PROPOSED BY DICOM SERVER AE FOR ACTIVITY *MODALITY PERFORMED PROCEDURE STEP NOTIFICATION*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.7.2.1 SOP Specific DICOM Conformance Statement for the Modality Performed Procedure Step SOP Class

Only one association is opened at a time. The association is open until the response message is returned from the SCP or a network error occurs. No other configurable timers are available.

If the remote AE does not support the proposed Presentation context, an appropriate error message is logged.

Following are the status codes that are more specifically processed when receiving an N-CREATE and N-SET response from an **MPPS SCP** equipment:

TABLE 19 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR ACTIVITY *MODALITY PERFORMED PROCEDURE STEP NOTIFICATION*

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Success	0000	Success	The system updates the state and indicates the same on the user interface.
Failure	0105	No such attribute	Error message is logged into the system log-file and indicates the status on the user interface.
	0106	Invalid attribute value	Error message is logged into the system log-file and indicates the status on the user interface.
	0110	Processing failure	Error message is logged into the system log-file and indicates the status on the user interface. Retries the operation after the configured time is elapsed.
	0112	No such SOP Instance	Error message is logged into the system log-file and indicates the status on the user interface.

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
	0115	Invalid argument value	Error message is logged into the system log-file and indicates the status on the user interface.
	0117	Invalid SOP Instance	Error message is logged into the system log-file and indicates the status on the user interface.
	0118	No such SOP Class	Error message is logged into the system log-file and indicates the status on the user interface.
	0119	Class-instance conflict	Error message is logged into the system log-file and indicates the status on the user interface.
	0120	Missing attribute	Error message is logged into the system log-file and indicates the status on the user interface.
	0144	No such argument	Error message is logged into the system log-file and indicates the status on the user interface.
	0210	Duplicate invocation	Error message is logged into the system log-file and indicates the status on the user interface.
	0211	Unrecognized operation	Error message is logged into the system log-file and indicates the status on the user interface.
	0212	Mistyped argument	Error message is logged into the system log-file and indicates the status on the user interface.
	0213	Resource limitation	Error message is logged into the system log-file and indicates the status on the user interface. Retries the operation after the configured time is elapsed.
	C002	Operation failed	Error message is logged into the system log-file and indicates the status on the user interface. Retries the operation after the configured time is elapsed.
*	*	Any other status code.	The operation is deemed 'Failed'. Detailed message is logged into the system log-file and indicates the status on the user interface. Retries the operation after the configured time is elapsed.

2.3.1.2.8 Real-World Activity: Print

2.3.1.2.8.1 Associated Real-World Activity

The Film Composer allows the user to select printers and it also allows the user to drag and drop the images (from viewer application) into the film. It also allows the user to manipulate some print parameters like film format and number of copies to print. When the user presses the "Print" Button, the Film Composer communicates this request to DICOM SERVER AE, which then tries to establish the association with requested printer and sends the images for printing.

2.3.1.2.8.1.1 Sequencing of Real-World Activities

Print application can be used in different ways:

- Autoprint feature.
- Manual print.
- Film composer.

To print automatically, the user has to configure it in Image preferences.

To print manually, the user has to select the DICOM printer, from Viewing Applications, and press Print Button.

To print with the Film Composer:

1. User has to select the DICOM printer from the Film Composer Interface.
2. The images to be printed shall be selected into Film Composer slots from Viewing Applications.
3. The user has to press the Print Button to print the images.

The DICOM SERVER AE will start the Print Session. The Print Session involves establishing association with the printer followed by the next sequence of activities:

a. The DICOM SERVER AE gets the Printer status using N-GET service. If the Printer returns FAILURE status the print session will be terminated and the requester will be notified of the printer status.

b. The film session is created using N-CREATE service. In case of error, the print session will be terminated. The attribute values for the Film session will be specified with the film session request.

c. The film box is created using N-CREATE service. The print session will be terminated if the printer fails to create the film box. The film box attribute values will be sent in the film box create request.

d. The image attributes for the images to be printed in this session will be set using the N-SET service. If the printer fails to accommodate the images in the image set, the print session will be terminated. If the user used “film composer”, they will be as many N-SET box as images in the film

e. The film will be printed using the N-ACTION service. Only film box printing is supported. In case of error, the print session will be terminated.

f. The Film Box instance will be deleted using the N-DELETE service.

g. The SCU does not wait for N-EVENT-REPORT from the Printer after deleting the film box instance. The N-EVENT-REPORT received when the association was still active is handled, but the data received will be ignored.

h. Finally, the association will be terminated and if all the above operations are successful the requester will be notified of the successful print session. This status just indicates that the images to be printed have been successfully sent to the printer.

NOTE: For Senographe Pristina 3D, the DBT volumes or projections cannot be printed.

2.3.1.2.8.2 Proposed Presentation Context

TABLE 20 - PRESENTATION CONTEXT– PROPOSED BY DICOM SERVER AE FOR ACTIVITY *PRINT*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Printer SOP Class	1.2.840.10008.5.1.1.16	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.8.2.1 SOP Specific DICOM Conformance Statement for Basic Grayscale Print Management SOP Class

The DICOM SERVER AE uses the following DIMSE services of the supported SOP Classes:

TABLE 21 - DIMSE SERVICES USED BY DICOM SERVER AE FOR ACTIVITY *PRINT*

SOP Class	SOP Class UID	DIMSE Service Element	SCU Usage
Basic Film Session	1.2.840.10008.5.1.1.1	N-CREATE	Used (Mandatory)
		N-SET	Not Used
		N-DELETE	Used
		N-ACTION	Not Used
Basic Film Box	1.2.840.10008.5.1.1.2	N-CREATE	Used (Mandatory)
		N-ACTION	Used (Mandatory)
		N-DELETE	Used
		N-SET	Not Used
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	N-SET	Used (Mandatory)
Printer	1.2.840.10008.5.1.1.16	N-EVENT-REPORT	Used (Mandatory)
		N-GET	Used

2.3.1.2.8.2.1.1 Basic Film Session SOP Class

The DICOM SERVER AE supports the following DIMSE Service Elements for the Basic Film Session SOP Class.

- N-CREATE: Requests the Print SCP to create an instance of Basic Film Session.

Only one association is opened at a time. The association is open until the response message is returned from the SCP or a network error occurs.

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Basic Film Session SOP Class N-CREATE:

TABLE 22 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR BASIC FILM SESSION SOP CLASS N-CREATE

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failure	0119	Class-instance conflict	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0210	Duplicate invocation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0111	Duplicate SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0106	Invalid attribute value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0117	Invalid SOP instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0120	Missing attribute	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0121	Missing attribute value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0212	Mistyped argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
	0105	No such attributes	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0118	No such SOP Class	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0112	No such SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0110	Processing failure	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0213	Resource limitation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0211	Unrecognized operation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Warning	B600	Memory allocation not supported	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Success	0000	Film session successfully created	Logs film session instance UID and proceeds for creating film box.
*	*	Any other status code.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

If a Failure/Warning status is returned by the Print SCP during the N-CREATE operation of the Film Session, the association will be terminated.

2.3.1.2.8.2.1.2 Basic Film Box SOP Class

The DICOM SERVER AE supports the following DIMSE Service Elements for the Basic Film Box SOP Class:

- N-CREATE: Requests the Print SCP to create an instance of Film Box.
- N-ACTION: Requests the Print SCP to print the Film Box onto Printer.
- N-DELETE: Requests the Print SCP to delete the Film Box Instance.

Only one association is opened at a time. The association is open until the response message is returned from the SCP or a network error occurs. No other configurable timers are available.

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Basic Film Box SOP Class N-CREATE:

TABLE 23 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR BASIC FILM BOX SOP CLASS N-CREATE

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failure	C616	There is an existing Film Box that has not been printed and N-ACTION at the Film Session level is not supported. A new Film Box will not be created when a previous Film Box has not been printed.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0119	Class-instance conflict	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0210	Duplicate invocation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0111	Duplicate SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0106	Invalid attribute value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0117	Invalid SOP instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0120	Missing attribute	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0121	Missing attribute value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0212	Mistyped argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0105	No such attributes	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0118	No such SOP Class	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0112	No such SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
	0110	Processing failure	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0213	Resource limitation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0211	Unrecognized operation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Warning	B605	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Success	0000	Film box successfully created	Proceed for setting image box.
*	*	Any other status code.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

If a Failure or Warning status is returned during the N-CREATE operation of the Film Box, the association will be terminated.

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Basic Film Box SOP Class N-ACTION:

TABLE 24 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR BASIC FILM BOX SOP CLASS N-ACTION

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failure	C602	Unable to create Print Job SOP Instance; print queue is full	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	C603	Image size is larger than image box size (by using the specified magnification value)	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	C604	Image position collision: multiple images assigned to single image position	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	C613	Combined Print Image size is larger than the Image Box size	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0119	Class-instance conflict	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0210	Duplicate invocation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0115	Invalid argument value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0117	Invalid SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
	0212	Mistyped argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0123	No such action	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0114	No such argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0118	No such SOP Class	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0112	No such SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0110	Processing failure	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0213	Resource limitation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0211	Unrecognized operation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Warning	B603	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page).	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	B604	Image size is larger than image box size, the image has been demagnified.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	B609	Image size is larger than the Image Box size. The Image has been cropped to fit.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	B60A	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Success	0000	Film accepted for printing; if supported, the Print Job SOP Instance is created.	Proceed in parsing N-Action response.
*	*	Any other status code.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

If a Failure or Warning status is returned during the N-ACTION operation of the Film Box, the association will be terminated.

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Basic Film Box SOP Class N-DELETE:

TABLE 25 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR BASIC FILM BOX SOP CLASS N-DELETE

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failure	0119	Class-instance conflict	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0210	Duplicate invocation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0117	Invalid SOP instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0212	Mistyped argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0118	No such SOP Class	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0112	No such SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0110	Processing failure	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0213	Resource limitation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0211	Unrecognized operation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Success	0000	Film box successfully deleted	Logs the success message.
*	*	Any other status code.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

If a Failure or Warning status is returned during the N-DELETE operation of the Film Box, the association will be terminated.

2.3.1.2.8.2.1.3 Basic Grayscale Image Box SOP Classes

The DICOM SERVER AE supports the following DIMSE Service Elements for Basic Grayscale and Color Image Box SOP Classes:

- N-SET: Requests the Printer to set the image box attributes.

Only one association is opened at a time. The association is open until the response message is returned from the SCP or a network error occurs. No other configurable timers are available.

If Film Composer is used to print several images in the same film, there are as much N-SET Basic Grayscale Image Box SOP Class as there are images selected in the film composer.

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Basic Grayscale and Color Image Box SOP Classes N-SET:

TABLE 26 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR BASIC GRAYSCALE BOX SOP CLASSES N-SET

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failure	C603	Image size is larger than image box size	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	C605	Insufficient memory in printer to store the image	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	C613	Combined Print Image size is larger than the Image Box size	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0119	Class-instance conflict	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0210	Duplicate invocation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0106	Invalid attribute value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0212	Mistyped argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0117	Invalid SOP instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0121	Missing attribute value	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0105	No such attributes	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0118	No such SOP Class	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0112	No such SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0110	Processing failure	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0213	Resource limitation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0211	Unrecognized operation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Warning	B604	Image size larger than image box size, the image has been demagnified.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	B605	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
	B609	Image size is larger than the Image Box size. The Image has been cropped to fit.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	B60A	Image size or Combined Print Image size is larger than the Image Box size. The Image or Combined Print Image has been decimated to fit.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Success	0000	Image successfully stored in Image Box	Continues setting image box if more images are there, else sends N-Action request.
*	*	Any other status code.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

If a Failure/Warning status is returned during the N-SET operation of the Image Box, the association will be terminated.

2.3.1.2.8.2.1.4 Printer SOP Class

The N-GET DIMSE service is supported for the Printer SOP Class. If an N-EVENT-REPORT DIMSE service is received when the association is active, the DICOM SERVER AE handles the relevant states, but the data received is ignored.

Following are the status codes the Application may send back in the **N-Event-Report** response command to the **Printer SOP Class** SCP Equipment that sent the N-Event-Report request:

TABLE 27 - STATUS CODES RETURNED BY DICOM SERVER AE FOR PRINTER SOP CLASS N-EVENT-REPORT

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Success	0000		N-EVENT-REPORT received successfully	None

The DICOM SERVER AE issues the N-GET service to retrieve the printer status. The statuses are processed as follows:

- If Printer status (2110,0010) is NORMAL, the film is printed.
- If Printer status (2110,0010) is FAILURE, the print job is terminated. The Printer Status Info (2110,0020) attribute is not processed.
- If Printer status (2110,0010) is WARNING, one of the following cases will happen:
  - If the Printer Status Info (2110,0020) is “RECEIVER FULL” or “SUPPLY EMPTY”, or “FILM JAM” the status is displayed to the user and the print job is aborted.
  - For all other Printer Status Info (2110,0020) values, the status is ignored and the print job continues.

Only one association is opened at a time. The association is open until the response message is returned from the SCP or a network error occurs. No other configurable timers are available.

For the attribute list requested by this product and for the behavior of this product on each returned value, refer to Section *8-5-2 Printer N-Get Attributes*.

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Printer SOP Class N-GET:

TABLE 28 - STATUS CODES RECEIVED BY DICOM SERVER AE FOR PRINTER SOP CLASS N-GET

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Failure	0107	Attribute list error	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0119	Class-instance conflict	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0210	Duplicate invocation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0117	Invalid SOP instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0212	Mistyped argument	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0118	No such SOP Class	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0112	No such SOP Instance	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0110	Processing failure	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0213	Resource limitation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
	0211	Unrecognized operation	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.
Success	0000	Success	Proceed with parsing dataset returned from N-Get response and perform appropriate operations.
*	*	Any other status code.	Fails print job and displays print failure message on Job Manager UI. Error details along with the status code is logged.

2-3-1-3 Association Acceptance Policy

The DICOM SERVER AE places limitations on who may connect to it.

If the Remote AE needs to “Push Images” or “Query/Retrieve Images”, to the local system then it has to be configured in the Local system.

Any remote AE can open an association to the DICOM SERVER AE for the purpose of verification.

The DICOM SERVER AE rejects the association if there are too many open connections.

2.3.1.3.1 Real-World Activity: Receive Images

The DICOM SERVER AE is indefinitely listening for associations. No user action is required to receive an image, once distant host is declared. The system is not accepting DBT images.

2.3.1.3.1.1 Associated Real-World Activity

The Real-World Activity associated with the *Receive Images* operation is the storage of the images on the disk drive of the local system and the declaration of the images in the database of the same station.

2.3.1.3.1.2 Accepted Presentation Context Table

TABLE 29 - PRESENTATION CONTEXT– ACCEPTED BY DICOM SERVER AE FOR ACTIVITY *RECEIVE IMAGES*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
X-Ray Radiation Dose Structure Report Information Storage	1.2.840.10008.5.1.4.1.1.88.67	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The DICOM SERVER AE provides Level 2 (FULL) Conformance, and stores all standard and private data elements of received SOP Instances. It does not coerce any data elements during Storage. The DICOM SERVER AE provides Level 1 Digital Signature support.

The DICOM SERVER AE monitors an “Operation Inactivity” timer. The connection with the SCU will be terminated if it is inactive for the time-out interval. Time-out is 15 seconds.

Successfully received SOP Instances may be accessed via the user interface and by DICOM network query retrieve. SOP Instances are stored until manually deleted by the user.

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Storage**:

TABLE 30 - STATUS CODES RETURNED BY DICOM SERVER AE FOR ACTIVITY *RECEIVE IMAGES*

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700	Refused: Out of resources	Not enough diskspace to store the DICOM object.	(0000,0902)
	A710	Refused: Out of resources	Remote AE is not given permission to store on DICOM SERVER AE.	(0000,0902)
	A711	Refused: Out of resources	Unable to connect to local database for storage (such as maximum connection limit reached).	(0000,0902)
	A900	Error: Data Set does not match SOP Class	Storage of the DICOM object failed due to corrupt/invalid dataset.	(0000,0902)
	C000	Error: Cannot understand	Error while storing DICOM object in the repository.	(0000,0902)
Success	0000	Success	DICOM instance stored successfully.	None

2.3.1.3.1.3 Presentation Context Acceptance Criterion

The DICOM SERVER AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

2.3.1.3.1.4 Transfer Syntax Selection Policies

Within each Presentation Context, the DICOM SERVER AE will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian.
2. Implicit VR Little Endian.
3. Explicit VR Big Endian.

2.3.1.3.2 Real-World Activity: Search Local Database

Not supported.

2.3.1.3.3 Real-World Activity: Move Images

Not supported.

2.3.1.3.4 Real-World Activity: Listen to remote Storage Commitment SCP

2.3.1.3.4.1 Accepted Presentation Context

The Storage Commitment Provider initiating the association must use the role selection negotiation.

TABLE 31 - PRESENTATION CONTEXT– ACCEPTED BY DICOM SERVER AE FOR ACTIVITY LISTEN TO REMOTE STORAGE COMMITMENT SCP

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.3.4.1.1 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class (N-EVENT-REPORT)

The DICOM SERVER AE monitors an “Operation Inactivity” timer. The connection with the SCU will be terminated if it is inactive for the time-out interval. Time-out is 15 seconds.

Once the N_EVENT_REPORT response is received from the SCP, the following actions will be taken depending on the status of response.

2.3.1.3.4.1.1.1 Commitment response with SUCCESS status

The “Archived” flag information in the browser for all the successfully archived exam/series will be updated. The archive status column in the browser will be changed to display “Archived” icon to indicate that the exam/series has been archived successfully. The job queue entry will be removed.

N_EVENT_REPORT response will be sent on the same association as N_EVENT_REPORT request. No data set will be sent along with the response.

Following are the status codes the Application may send back to the SCP Equipment after receiving the N-EVENT-REPORT:

TABLE 32 - STATUS CODES RETURNED BY DICOM SERVER AE FOR ACTIVITY *LISTEN TO REMOTE STORAGE COMMITMENT SCP* WITH SUCCESS STATUS

Service Status	Status Codes	Further Meaning	Status Code sending explanation	Related Fields sent back to the SCU
Error	0110	Processing Failure	Indicates that an internal error occured while processing.	None
Success	0000	Success	The storage commitment result received successfully.	None

2.3.1.3.4.1.1.2 Commitment response with FAILURE status

In the event of complete/partial failure, the user will be notified about the status and the job entry will be paused. There is no attempt made to automatically retry the failed SOP instances. However, the user can manually retry the failed jobs from the job queue. Such requests will be treated as new requests. This will go through the complete sequence of operations once again.

The failure reason is ignored. Failed SOP instances will have their "Archived" flag information unaltered.

N_EVENT_REPORT response will be sent on the same association as N_EVENT_REPORT request. No data set will be sent along with the response.

See section *6-1-2-1* for the complete list of N_EVENT_REPORT failure statuses processed by the system.

Following are the status codes the Application may send back to the SCP Equipment after receiving the N-EVENT-REPORT:

TABLE 33 - STATUS CODES RETURNED BY DICOM SERVER AE FOR ACTIVITY *LISTEN TO REMOTE STORAGE COMMITMENT SCP* WITH FAILURE STATUS

Service Status	Status Codes	Further Meaning	Status Code sending explanation	Related Fields sent back to the SCU
Error	0110	Processing Failure	Indicates that an internal error occured while processing.	None
Success	0000	Success	The storage commitment result received successfully.	None

2.3.1.3.5 Real-World Activity: Verify Connectivity

2.3.1.3.5.1 Associated Real-World Activity

A remote Application Entity verifies its ability to communicate with DICOM SERVER AE by sending a verification request.

2.3.1.3.5.2 Accepted Presentation Context

TABLE 34 - PRESENTATION CONTEXT– ACCEPTED BY DICOM SERVER AE FOR ACTIVITY *VERIFY CONNECTIVITY*

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

2.3.1.3.5.2.1 SOP Specific DICOM Conformance Statement for Verification SOP class

The DICOM SERVER AE provides standard conformance.

The DICOM SERVER AE monitors an “Operation Inactivity” timer. The connection with the SCU will be terminated if it is inactive for the time-out interval. Time-out is 15 seconds.

2.3.1.3.5.3 Presentation Context Acceptance Criterion

The DICOM SERVER AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

2.3.1.3.5.4 Transfer Syntax Selection Policies

Within each Presentation Context, the DICOM SERVER AE will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian.
2. Implicit VR Little Endian.
3. Explicit VR Big Endian.

2-4 Communication Profiles

2-4-1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the operating system.

2-4-2 Physical Media Support

The product is provided with a 1Gb/s auto-sensing Ethernet interface.

2-4-3 Additional Protocols

Senographe Pristina supports the following System Management Profiles and configuration management protocols as defined in DICOM PS3.15.

TABLE 35 - SYSTEM MANAGEMENT PROFILES

Profile Name	Actor	Protocols Used	Optional Transactions	Security Support
Basic Time Synchronization Profile	NTP Client	NTP	N/A	None

NTP configuration is provided through the operating system. See the appropriate product service documentation.

NOTE: DHCP is not supported.

2-4-4 IPv4 and IPv6 Support

This product supports only IPv4 connection.

2-5 Extensions / Specializations/ Privatizations

2-5-1 Standard Extended / Specialized / Private SOP Classes

2-5-1-1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to all supported SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements. The extensions are defined in Sections 9 and 10 and 11.

2-5-1-2 Private SOP Class

Not applicable.

2-5-2 Private Transfer Syntaxes

Not applicable.

2-6 Configuration

2-6-1 AE Title/Presentation Address Mapping

Not applicable.

2-6-2 Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title (by default the value is the station name).
- Local IP Address.
- Local IP Netmask.

The Local Listening **Port Number** for C-STORE SCP DICOM service is not configurable and set to **4006.**

The Local Listening **Port Number** for STORAGE COMMITMENT DICOM service is not configurable and set to **4006.**

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address / Hostname
- Listening TCP/IP Port Number

A **default router** IP Address for **all remote nodes** can be configured as well as some specific routes.

2-7 Support of Extended Character Sets

The Defined Terms for Specific Character Set in Table 36 are supported by Senographe Pristina:

TABLE 36 - SUPPORTED SPECIFIC CHARACTER SET DEFINED TERMS

Defined Term	Character Set Description
ISO_IR 100	Latin alphabet No. 1*
ISO_IR 101	Latin alphabet No. 2
ISO_IR 109	Latin alphabet No. 3
ISO_IR 110	Latin alphabet No. 4
ISO_IR 126	Greek
ISO_IR 127	Arabic
ISO_IR 138	Hebrew
ISO_IR 144	Cyrillic
ISO_IR 148	Latin alphabet No. 5
ISO_IR 6	Default repertoire
ISO_IR 13	Japanese
ISO_IR 166	Thai
ISO_IR 192	Unicode in UTF-8**
ISO 2022 IR 6	Default repertoire
ISO 2022 IR 13	Japanese
ISO 2022 IR 87	Japanese
ISO 2022 IR 100	Latin alphabet No. 1
ISO 2022 IR 101	Latin alphabet No. 2
ISO 2022 IR 109	Latin alphabet No. 3
ISO 2022 IR 110	Latin alphabet No. 4
ISO 2022 IR 126	Greek
ISO 2022 IR 127	Arabic
ISO 2022 IR 138	Hebrew
ISO 2022 IR 144	Cyrillic
ISO 2022 IR 148	Latin alphabet No. 5
ISO 2022 IR 149	Korean
ISO 2022 IR 159	Japanese
ISO 2022 IR 166	Thai
GB18030	Chinese

NOTES: * ISO_IR 100 is the Character Set supported by the Senographe Pristina for Storage SCP

**ISO_IR 192 is the default Character Set for Query SCU.

As a Storage SCP, the product will not accept SOP Instances that contain unsupported character sets. The system will return appropriate failure status code.

As a Query SCU, it will accept response items with any value of Specific Character Set. However, it will display in the user interface only characters specified as within ISO_IR 6 (ASCII) or ISO_IR 100.

The product user interface will allow the user to enter characters that are within ASCII or ISO_IR 100.

As a Modality Worklist SCU, it only uses ISO_IR 100 Specific Character Set in the worklist query requests.

2-8 Security Profiles

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to the product.
- Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
- Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN)).

It is recommended that:

- The system is connected to a secured network, not open to unintended users and hosts.
- The Senographe Pristina computer is physically secured in a way that it is not physically accessible to unintended users.
- Default application users and passwords are replaced with customized users and passwords.
- External media containing images, patient data, reports and logs is secured. When no longer used, the data is securely erased and/or the media is securely deleted or destroyed.
- The monitors of the Senographe Pristina system are placed in a way limiting the visibility to the user only.

3 Media Storage Conformance Statement

3-1 Introduction

This section of the DICOM conformance statement specifies the Senographe Pristina system compliance to DICOM requirements for **Media Interchange**. It details the DICOM Media Storage Application Profiles and roles that are supported by this product.

The Senographe Pristina system provides capabilities to DICOM Media Interchange on CD (Compact Disc), DVD (Digital Video Disc – Recordable) and USB Storage device with VFAT filesystem.

Export of DBT images is supported but not the import of DBT images from media.

3-2 Implementation Model

3-2-1 Application Data Flow Diagram

The media interchange application model for the Senographe Pristina system is shown in the following Illustration:

The DICOM Media Interchange Application Entity (AE) handles the DICOM CREATE/RESTORE functionality for the CD/DVD and USB storage media. The DICOM Media Interchange AE is commanded by the user to perform DICOM services operating on the DICOM media through the use of buttons and menu selections on the graphical user interface of the platform.

The user requests the creation of a DICOM File Set and the writing of this DICOM File Set on blank Interchange Media by selecting images in the local Browser and selecting the Interchange Media as being the selected device. Then, the iso9660 image of the CD/DVD to burn will be generated. Once the generation has been done, it burns the complete set of data on the selected Interchange Media. For USB Storage media with VFAT filesystem, DICOM File Set is copied to blank Interchange media.

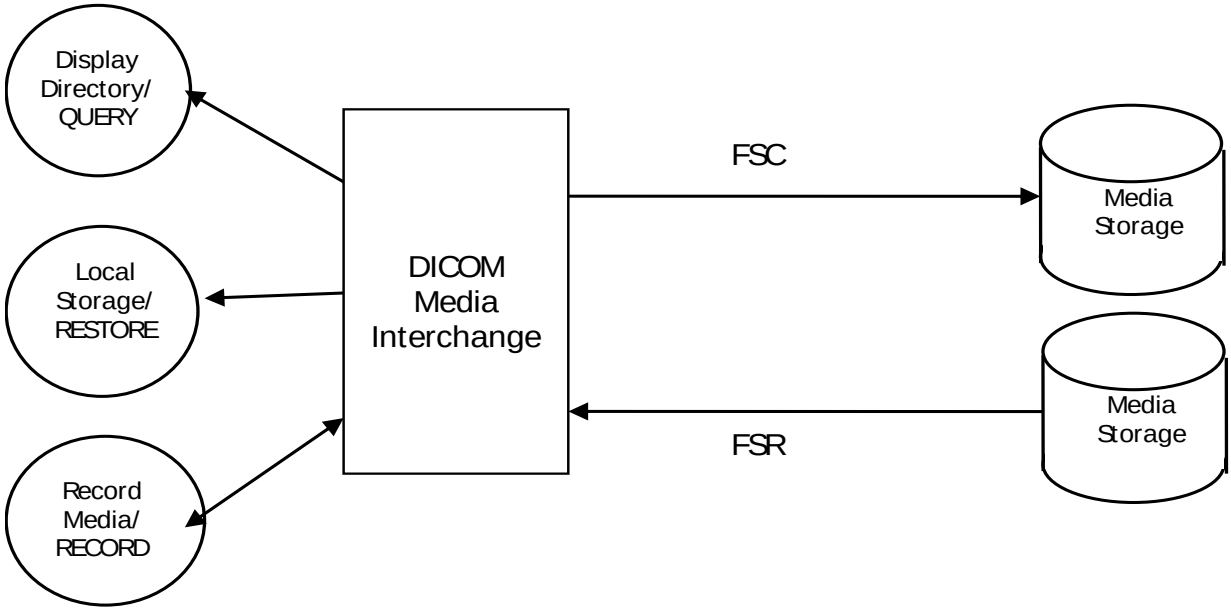


FIGURE 2 - SENOGRAPHE PRISTINA SYSTEM MEDIA INTERCHANGE APPLICATION MODEL AND DATA FLOW DIAGRAM

The DICOM Media Interchange AE has a local storage that may contain various SOP instances. These may have been obtained by original creation, network (DICOM or proprietary) or by removable media

using other application entities. These instances are external to this conformance claim and the origin of SOP instances is outside the scope of this claim.

The Media Creator initializes Media by acting as an FSC to create a new DICOM File-set on a 700MB CD/4.7GB DVD/USB Storage(no size limit) blank Interchange Media. It initializes the DICOM File-set and writes all the specified SOP instances onto the Interchange Media at once. The SOP instances written will be limited to instances that match the criteria of one of the Application Profiles that is supported. Updating the media is not supported.

The DICOM Media Interchange AE acts as an FSR when requested to browse the Interchange Media such that user can select the SOP instances that he wants the DICOM Media Interchange AE to copy on the local database by selecting appropriate Study/Series/Image instances.

The supported media during creation and restore are listed below:

TABLE 37 – SUPPORTED MEDIA

Media	Supported during Media Create (FSC)	File System supported (FSC)	Supported during Media Restore (FSR)	File System supported (FSR)
CD -R	YES	ISO 9660	YES	ISO 9660
DVD -R	YES	ISO 9660	YES	ISO 9660 & UDF
USB Storage (VFAT file system)	YES	VFAT	YES	VFAT

3-2-2 Functional Definition of AE's

The DICOM Media Interchange AE supports the following functions:

- Generate and write a DICOM File Set (FSC) in a one shot activity (SAVE).
- Read a DICOM File Set (FSR) on an Interchange Media (QUERY).
- It can copy SOP instances from the media onto local storage (RESTORE).

3-2-3 Sequencing of Real-World Activities

Not Applicable.

3-2-4 File Meta Information Options (See PS3.10)

The File Meta-Information for this implementation is:

Source Application Entity Title	If present in composite object instances, it will be set to same value. Otherwise, not present.
File Meta-Information Version	1
Implementation UID	1.2.826.0.1.3680043.2.60.0.1
Implementation Version Name	MEDIACREATOR_V1

3-3 AE Specifications

3-3-1 DICOM Media (CD/DVD/USB) Interchange AE Specification

The DICOM Media (CD/DVD/USB) Interchange AE provides standard conformance to DICOM Media Interchange Option of the Media Storage Service Class. The supported Application Profiles and roles are listed below:

TABLE 38 - SUPPORTED APPLICATION PROFILES AND ROLES

Supported Application Profile	Real World Activity	Role
STD-GEN-CD	CREATE CD	FSC
STD-GEN-CD	QUERY CD	FSR
STD-GEN-CD	RESTORE CD	FSR
STD-GEN-DVD-JPEG	CREATE DVD	FSC
STD-GEN-DVD-JPEG	QUERY DVD	FSR
STD-GEN-DVD-JPEG	RESTORE DVD	FSR
STD-GEN-USB-JPEG	CREATE USB	FSC
STD-GEN-USB-JPEG	QUERY USB	FSR
STD-GEN-USB-JPEG	RESTORE USB	FSR

3-3-1-1 File Meta Information for the DICOM Media Interchange AE

Refer to section *3-2-4*.

3-3-1-2 Real-World Activities for the DICOM Media Interchange AE

3.3.1.2.1 Real-World Activity Create (Generate and Write) CD/DVD/USB Storage

The DICOM Media Interchange AE acts as an FSC using the interchange option when requested to copy SOP Instances from the local database to a CD/DVD/USB Storage.

The user selects the entries in the local database that s/he wants the DICOM Media Interchange AE to copy onto Interchange Media.

The graphic interface allows the user to select the entries (studies, series or images) in the local database to be copied onto to the selected Interchange Media.

The DICOM Media Interchange AE creates one File Set per generated Interchange Media.

- A user can only create one copy of CD/DVD/USB image for a drive at a time; any other attempt of creation will not be allowed until the first one is complete or cancelled.
- A user cannot create CD/DVD/USB while restore CD/DVD/USB is in process.
- A DICOM Media Viewer is provided along with the selected object instances on the interchange media.

Before writing on the Interchange Media, the DICOM Media Interchange AE checks for the following condition:

The inserted media is blank and write-able. If the condition is not met, an error is displayed and the user needs to replace it with a blank media.

Following are the SOP Classes supported by this AE. All SOP Instances use the Explicit VR Little Endian Uncompressed Transfer Syntax, UID 1.2.840.10008.1.2.1.

TABLE 39 - SOP CLASSES SUPPORTED BY ACTIVITY *CREATE CD/DVD/USB STORAGE*

SOP Class	SOP Class UID
Digital Mammography X-Ray Image Storage- For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-Ray Image Storage- For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Breast Tomosynthesis Image Storage [3D only]	1.2.840.10008.5.1.4.1.1.13.1.3

NOTE: [3D only] Only for Senographe Pristina 3D and Pristina Serena 3D.

3.3.1.2.1.1 Application Profile for the RWA Create CD/DVD/USB Storage

Refer to Section *3-3-1* for the list of Application Profiles that invoke this AE for the Create CD/DVD/USB Storage RWA.

3.3.1.2.1.1.1 Options for STD-GEN-CD Application Profile:

Refer to Table 40 for SOP Classes supported by this AE.

Common DICOMDIR Directory Records created by this AE will include key attributes as described in Section *7 - Basic DICOM Directory Information Object Implementation*.

3.3.1.2.1.1.2 Options for STD-GEN-DVD-JPEG Application Profile

Refer to Table 40 for SOP Classes supported by this AE.

Common DICOMDIR Directory Records created by this AE will include key attributes as described in Section *7 - Basic DICOM Directory Information Object Implementation*.

3.3.1.2.1.1.3 Options for STD-GEN-USB-JPEG Application Profile

Refer to Table 40 for SOP Classes supported by this AE.

Common DICOMDIR Directory Records created by this AE will include key attributes as described in Section *7 - Basic DICOM Directory Information Object Implementation*.

3.3.1.2.2 Real-World Activity Display CD/DVD/USB Storage – QUERY

The DICOM Media Interchange AE acts as an FSR using the interchange option when requested to browse the Interchange Media.

When the DICOM Media Interchange AE is requested to provide a directory listing, it reads the File-set and displays the DICOMDIR directory entries, according to the STUDY Root paradigm.

If the media is not blank, then Interchange Media gets mounted. To remove the media, the user has to select the eject button on user interface for the appropriate drive.

A user cannot display the directory when create/restore CD/DVD/USB is in progress.

3.3.1.2.2.1 Application Profile for the RWA Display CD/DVD/USB Storage

For the list of Application Profiles that invoke this AE for the Display Directory CD/DVD/USB Storage RWA, see Table 38.

3.3.1.2.2.1.1 Options for STD-GEN-CD/STD-GEN-DVD-JPEG/STD-GEN-USB-JPEG Application Profile

Common DICOMDIR Directory Records read by this AE will include key attributes as described in Section *7 - Basic DICOM Directory Information Object Implementation*.

Following are the SOP Classes supported by the RWA “Display Directory of CD/DVD/USB Storage:

TABLE 40 - SOP CLASSES SUPPORTED BY ACTIVITY *DISPLAY CD/DVD/USB STORAGE*

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1

Refer Sections *3.3.1.2.1.1.1, 3.3.1.2.1.1.2* and *3.3.1.2.1.1.3* for the additional DICOMDIR keys, which are read (if present).

3.3.1.2.3 Real-World Activity Restore CD/DVD/USB Storage

The DICOM Media (CD/DVD /USB Storage) Interchange AE acts as an FSR using the interchange option when requested to copy SOP instances from the CD/DVD/USB to the local database.

The user selects the SOP instances that he wants the DICOM Media Interchange AE to copy on the local database by selecting appropriate Study/Series/Image instances and clicking on the suitable restore buttons. Once selected, the SOP instances are copied from the media to the local database. Only supported images are resorted.

If the media is not blank, then the Interchange Media gets mounted. To remove the media, the user has to select the eject button on the User Interface for the appropriate drive.

A user cannot restore CD/DVD/USB while create CD/DVD/USB is in process.

A user can only restore selected composite objects at a time from a media; any other attempt of selections to restore CD/DVD/USB on media in same drive will wait until the first one is completed.

3.3.1.2.3.1 Application Profile for the RWA Restore CD/DVD/USB Storage

For the list of Application Profiles that invoke this AE for the Display Directory CD/DVD/USB Storage RWA, see Table 38.

3.3.1.2.3.1.1 Options for STD-GEN-CD/STD-GEN-DVD-JPEG/STD-GEN-USB-JPEG Application Profile

Common DICOMDIR Directory Records read by this AE will include key attributes as described in Section *7 - Basic DICOM Directory Information Object Implementation*.

Following are the SOP Classes supported by the RWA Restore CD/DVD/USB Storage:

TABLE 41 - SOP CLASSES SUPPORTED BY ACTIVITY *RESTORE CD/DVD/USB STORAGE*

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
See *Table 40*	See *Table 40*	Explicit VR Little Endian	1.2.840.10008.1.2.1

3-4 Augmented and Private Application Profiles

No augmented/private profile is implemented.

3-5 Extensions / Specializations / Privatizations

None.

3-6 Configuration

None.

3-7 Support of Extended Character Sets

The DICOM Media Interchange AE will support copy of SOP instances containing the ISO IR 100 (Latin alphabet No. 1, supplementary set), GB18030, ISO 2022 IR 13\ISO 2022 IR 87 and DICOM default character sets as defined in PS3.5.

3-8 IHE Integration

3-8-1 IHE PDI

The Senographe Pristina supports the Integrating the Healthcare Enterprise (IHE) Portable Data for Imaging (PDI) Profile as Portable Media Creator, Portable Media Importer, and Image Display actors.

Table 42 lists the IHE PDI profile options supported by Portable Media Creator.

TABLE 42 - SUPPORT OF IHE PDI PROFILE AS PORTABLE MEDIA CREATOR

Option	Support
Write to DVD Media	Yes
Write to USB Media	Yes
Add Basic Viewer	Yes
Media Labelling	Yes
Privacy Protection	No
Sending Software	No
WEB Content	No

Portable Media Importer and Image Display actors are supported for reading media.

4 Modality Worklist Query Implementation

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed.

4-1 Modality Worklist Information Model Entity-Relationship Model

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Figure 3. It represents the information that composes a Worklist Item. In this figure, the following diagrammatic convention is established to represent the information organization:

- each entity is represented by a rectangular box.
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between 2 entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

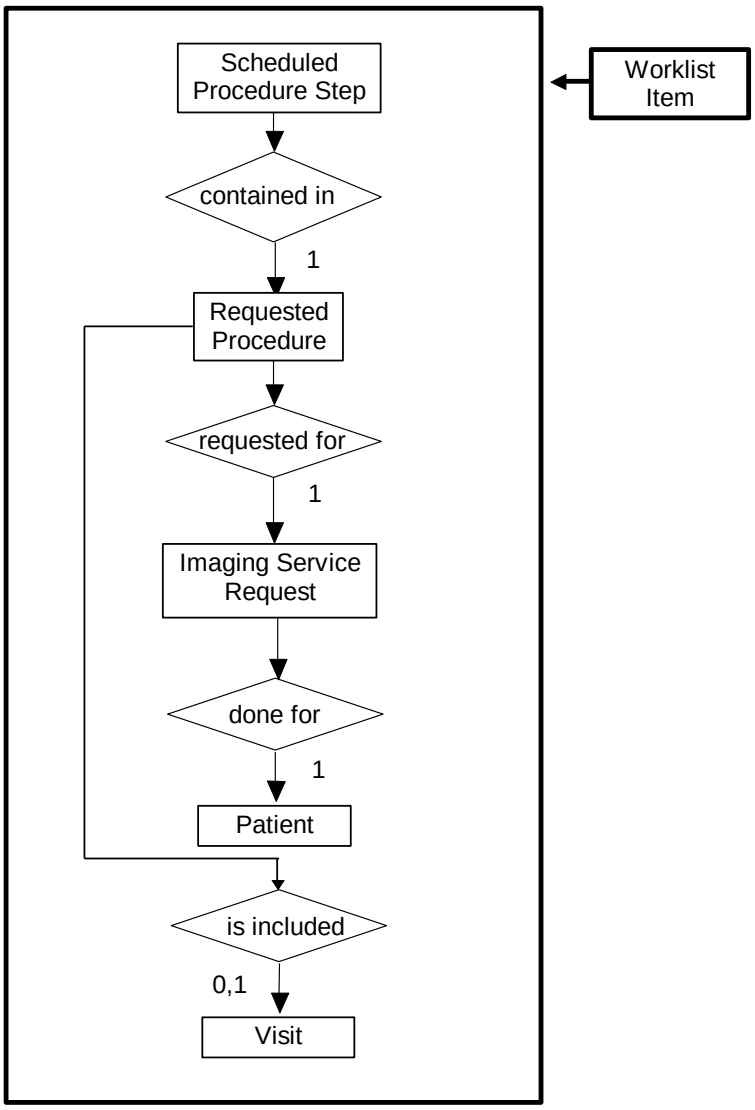


FIGURE 3 - MODALITY WORKLIST INFORMATION MODEL E/R DIAGRAM

4-1-1 Entity Descriptions

Refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

4-1-1-1 Scheduled Procedure Step

A Scheduled Procedure Step is an arbitrarily defined scheduled unit of service that is specified by the Procedure Plan for a Requested Procedure. It specifies one or more Action Items (events) involving equipment (i.e. imaging modality equipment), human resources, location and time (i.e. start time, stop time, duration).

4-1-1-2 Requested Procedure Entity Description

A Requested Procedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider.

4-1-1-3 Imaging Service Request Entity Description

An Imaging Service Request is a set of one or more Requested Procedures selected from a list of Procedure Types. An Imaging Service Request is submitted by one authorized imaging service requester to one authorized imaging service provider in the context of one Service Episode.

4-1-1-4 Visit Entity Description

A Visit is the context in which the treatment or management of an arbitrary subset of a Patient's medical conditions occurs. A Visit is limited to the description of a Patient's activities at a single facility.

4-1-1-5 Patient Entity Description

A Patient is a person receiving, or registered to receive, healthcare services.

4-2 Senographe Pristina Mapping of DICOM Entities

The Senographe Pristina maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 43 - MAPPING OF DICOM ENTITIES TO SENOGRAPHE PRISTINA ENTITIES

DICOM	Senographe Pristina Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Exam
Patient	Patient

4-3 Modality Worklist Information Model Module

Within an entity of the DICOM Modality Worklist Information Model, attributes are grouped together into related set of attributes called modules. A module facilitates the understanding of the semantics concerning the attributes and how the attributes relate to one another. A module grouping does not infer any encoding of information into datasets.

Table 44 identifies the defined modules within the entities which comprise the DICOM Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

TABLE 44 - MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	*Section 4-4-2-1*
	Scheduled Procedure Step	*Section 4-4-2-2*
Requested Procedure	Requested Procedure	*Section 4-4-3-1*
Imaging Service Request	Imaging Service Request	*Section 4-4-4-1*
Visit	Visit Identification	*Section 4-4-5-1*
	Visit Status	*Section 4-4-5-2*
	Visit Relationship	*Section 4-4-5-3*
	Visit Admission	*Section 4-4-5-4*
Patient	Patient Relationship	*Section 4-4-6-1*
	Patient Identification	*Section 4-4-6-2*
	Patient Demographic	*Section 4-4-6-3*
	Patient Medical	*Section 4-4-6-4*

4-4 Information Model Keys

Refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

The following Module descriptions contain the attributes, which are present in a C-FIND request message sent by the DICOM SERVER AE to a remote AE. It should be noted that they are the same as those defined in the DICOM Standard, PS 3.4 (Service Class Specifications). Required attributes for the Senographe Pristina are also indicated.

- **Attribute Name.**
- **Tag**: group and element numbers.
- **Mapped into The Instance / MMPS**: Whether this data is mapped into subsequently acquired images.
- **Notes**: Clarification of this implementation's use/treatment of this attribute.

All data elements in the following Module descriptions are following rules described in sections *2 - Network Conformance Statement*, *2-3 - AE Specifications*, and *2-3-1 - DICOM SERVER AE Specification.*

All data elements in the following Module descriptions are requested by the DICOM SERVER AE if requested by the user. Values of data elements that are not mapped into images, and that are not otherwise dealt with (displayed on the user interface, etc.) are not used and thus, are discarded upon receipt – although they may be used to filter the entries returned.

Data elements for which values can be sent for matching purposes are described as such. Data elements for which values are not sent are sent with zero length and universal matching will apply. This is the default case if no other description to the contrary is provided.

4-4-1 Supported Matching

The following are the types of matching that can be requested by the implementation:

- Single Value matching.
- Universal matching.
- Range of date/time matching

- Wildcard matching.

4-4-2 Common Scheduled Procedure Step Entity Modules

4-4-2-1 SOP Common Module

TABLE 45 - SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Specific Character Set	(0008,0005)	O	1C	No/No	This attribute is part of MWL query. See *section 4.4.2.1.1*.

4.4.2.1.1 Specific Character Set

ISO_IR_100 is the Specific Character Set (0008, 0005) value sent during querying and while interpreting response.

4-4-2-2 Scheduled Procedure Step Module

TABLE 46 - SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No/No	Requested in the MWL queries.
>Scheduled Station AE Title	(0040,0001)	R	1	No/No	Requested in the MWL queries. Matching is supported as follows: 1. No AE title is supplied (universal matching), 2. Worklist AET is supplied for matching (Single value matching). In case of universal matching, if attribute is absent or empty in response, the SPS will be accepted
>Scheduled Procedure Step Start Date	(0040,0002)	R	1 *	No/No	Requested in the MWL queries. If attribute is absent or empty in answer, the SPS is accepted. If value received is outside of a valid range, the value will be set to zero length (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) . Matching is supported as one of the following: 1. No date is supplied (universal matching). 2. One date is supplied for matching (Single value matching). 3. A start date and a end date is supplied for matching (Range of date matching). See *section 2.3.1.2.6.1 Associated Real-World Activity* for corresponding user's actions.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
>Scheduled Procedure Step Start Time	(0040,0003)	R	1 *	No/No	Requested in the MWL queries with zero-length value. If attribute is absent or empty in answer, the SPS is accepted. If value received is outside of a valid range, the value will be set to zero length (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*).
>Scheduled Procedure Step End Date	(0040,0004)	O	3	No/No	Not requested.
>Scheduled Procedure Step End Time	(0040,0005)	O	3	No/No	Not requested.
>Modality	(0008,0060)	R	1	No/No	Requested in the MWL queries. Matching is supported as follows: 1. No modality is supplied (universal matching). 2. Single Value MG is supplied for matching (Single value matching). If attribute is absent or empty in answer, the SPS is accepted.
>Scheduled Performing Physician's Name	(0040,0006)	R	2 *	Yes/Yes	Requested in the MWL queries with zero-length value. if received value is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. Value is copied to image in attribute Performing Physician's Name (0008,1050). If element is absent or empty in response, the SPS will be accepted and attribute will not be copied to image (except if edited by the user beforehand).

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
>Scheduled Procedure Step Description	(0040,0007)	O	1C *	Yes/Yes	Requested in the MWL queries with zero-length value. If value is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If element is absent or empty in answer, the SPS will be accepted and attribute value will not be copied to images. Attribute is copied to images into Request Attribut Sequence (0040,0275). If Requested Procedure Description (0032,1060) and Requested Procedure Code Seq. (0032,1064) code meaning tag values are absent or empty, the value is also copied to Study description (0008,1030) in images.
>Scheduled Station Name	(0040,0010)	O	2	No/No	Not requested.
>Scheduled Procedure Step Location	(0040,0011)	O	2	No/No	Not requested.
>Scheduled Protocol Code Sequence	(0040,0008)	O	1C	Yes/Yes	Requested in the MWL queries. Sequence is copied in images within sequence Request Attribut Sequence (0040,0275) If the sequence is absent or empty in answer, the SPS will be accepted and attribute will not be copied to images. If sequence is present but incomplete in answer (missing a mandatory attribute) the SPS will be accepted and correction will be applied for image correctness (see *section 9*).
>>Code Value	(0008,0100)	O	1	Yes/Yes	Requested in the MWL queries. If answer is received with absent or empty code value in code sequence, the SPS will be accepted. Sequence will be corrected at image creation.
>>Coding Scheme Designator	(0008,0102)	O	1	Yes/Yes	Requested in the MWL queries. If answer is received with absent or empty code value in code sequence, the SPS will be accepted. Sequence will be corrected at image creation.
>>Coding Scheme Version	(0008,0103)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
>>Code Meaning	(0008,0104)	O	3	Yes/Yes	Requested in the MWL queries. If answer is received with absent or empty code value in code sequence, the SPS will be accepted. Sequence will be corrected at image creation.
>Pre-Medication	(0040,0012)	O	2C	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
>Scheduled Procedure Step ID	(0040,0009)	O	1	Yes/Yes	Requested in the MWL queries. If value is not correct in answer, SPS will be accepted and value will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in answer, replaced by (0040,1001). Requested Procedure ID value before usage. If it is also absent or empty, replaced by # before usage. Copied to images in Request Attribute Sequence (0040,0275).
>Requested Contrast Agent	(0032,1070)	O	2C	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
>Scheduled Procedure Step Status	(0040,0020)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
>Comments on the Scheduled Procedure Step	(0040,0400)	O	3	No/No	Not requested.

NOTE: * indicates that this information is displayed on screen, if available.

4-4-3 Common Requested Procedure Entity Modules

4-4-3-1 Requested Procedure Module

TABLE 47 - REQUESTED PROCEDURE MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Requested Procedure ID	(0040,1001)	O	1*	Yes/Yes	Requested in the MWL queries. Matching is supported as follows: 1. No value is supplied (universal matching). 2. ID value is supplied for matching (Single value matching). If absent or empty in answer, the SPS is accepted and value is replaced by #. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. Attribute is copied to image within Request Attribut Sequence (0040,0275) and its value is copied to Study ID (0020,0010).
Requested Procedure Description	(0032,1060)	O	1C *	Yes/Yes	Requested in the MWL queries. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in answer, the SPS is accepted and other values might be used for copy to image. Attribute is copied to image within Request Attribut Sequence (0040,0275) and its value is copied to Study Description (0008,1030).
Requested Procedure Code Sequence	(0032,1064)	O	1C	Yes/Yes	Requested in the MWL queries. If sequence is absent or empty in answer, the SPS will be accepted and sequence not copied to image. If sequence is present but incomplete in answer (missing a mandatory attribute), the SPS will be accepted and correction will be applied for image correctness. Sequence content is copied in images in Procedure Code Sequence (0008,1032).

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
>Code Value	(0008,0100)	O	1C	Yes/Yes	Requested in the MWL queries. If answer is received with absent or empty code value in code sequence, the SPS will be accepted. Sequence will be corrected at image creation.
>Coding Scheme Designator	(0008,0102)	O	1C	Yes/Yes	Requested in the MWL queries. If answer is received with absent or empty coding scheme designator in code sequence, the SPS will be accepted. Sequence will be corrected at image creation.
>Coding Scheme Version	(0008,0103)	O	3	No/No	Requested in the MWL queries. If answer is received with absent or empty coding scheme version in code sequence, the SPS will be accepted.
>Code Meaning	(0008,0104)	O	3	Yes/Yes	Requested in the MWL queries. If answer is received with absent or empty code meaning in code sequence, the SPS will be accepted. Sequence will be corrected at image creation.
Study Instance UID	(0020,000D)	O	1	Yes/Yes	Requested in the MWL queries. If absent or empty in answer, SPS is accepted and value is autogenerated. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage.
Study Date	(0008,0020)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Study Time	(0008,0030)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Referenced Study Sequence	(0008,1110)	O	2	Yes/Yes	Requested in the MWL queries. If absent or empty in answer, SPS is accepted and sequence is not copied to images. If sequence is incomplete (missing a mandatory attribute), the SPS is accepted and sequence is not copied to images.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
>Referenced SOP Class UID	(0008,1150)	O	1C	Yes/Yes	Requested in the MWL queries. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in sequence, SPS is accepted and the sequence is not copied to images.
>Referenced SOP Instance UID	(0008,1155)	O	1C	Yes/Yes	Requested in the MWL queries. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in sequence, SPS is accepted and the sequence is not copied to images.
Requested Procedure Priority	(0040,1003)	O	2	No/No	Not requested.
Patient Transport Arrangements	(0040,1004)	O	2	No/No	Not requested.
Requested Procedure Location	(0040,1005)	O	3	No/No	Not requested.
Confidentiality Code	(0040,1008)	O	3	No/No	Not requested.
Reporting Priority	(0040,1009)	O	3	No/No	Not requested.
Names of Intended Recipients of Results	(0040,1010)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Reason for the Requested Procedure	(0040,1002)	O	3	No/No	Not requested.
Requested Procedure Comments	(0040,1400)	O	3	No/No	Not requested.

NOTE: * indicates that this information is displayed on screen, if available.

4-4-4 Common Imaging Service Request Entity Modules

4-4-4-1 Imaging Service Request Module

TABLE 48 - IMAGING SERVICE REQUEST MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Accession Number	(0008,0050)	O	2 *	Yes/Yes	Requested in the MWL queries. Matching is supported as follows: 1. No value is supplied (universal matching). 2. one value is supplied for matching (Single value matching). If absent or empty in answer, the SPS is accepted, attribute will be empty in images. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage.
Issuer of Accession Number Sequence	(0008,0051)	O	3	No/No	Not requested.
Requesting Physician	(0032,1032)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Requesting Physician Identification Sequence	(0032,1031)	O	3	No /No	Not requested.
Referring Physician's Name	(0008,0090)	O	2 *	Yes/No	Requested in the MWL queries with zero-length value. If absent or empty in answer, the SPS is accepted and attribute is created empty in images. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage.
Referring Physician Identification Sequence	(0008,0096)	O	3	No/No	Not requested.
Requesting Service	(0032,1033)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Requesting Service Code Sequence	(0032,1034)	O	3	No/No	Not requested.
Imaging Service Request Comments	(0040,2400)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Issue Date of Imaging Service Request	(0040,2004)	O	3	No/No	Not requested.
Issue Time of Imaging Service Request	(0040,2005)	O	3	No/No	Not requested.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Order Placer Identifier Sequence	(0040,0026)	O	3	No/No	Not requested.
Order Filler Identifier Sequence	(0040,0027)	O	3	No/No	Not requested.
Placer Order Number / Imaging Service Request	(0040,2016)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Filler Order Number / Imaging Service Request	(0040,2017)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Order entered by ...	(0040,2008)	O	3	No/No	Not requested.
Order Enterer's Location	(0040,2009)	O	3	No/No	Not requested.
Order Callback Phone Number	(0040,2010)	O	3	No/No	Not requested.
Order Callback Telecom Information	0040,2011)	O	3	No/No	Not requested.

NOTE: * indicates that this information is displayed on screen, if available

4-4-5 Common Visit Entity Modules

4-4-5-1 Visit Identification

TABLE 49 - VISIT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Admission ID	(0038,0010)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Institution Name	(0008.0080)	O	3	No/No	Not requested.
Institution Address	(0008,0081)	O	3	No/No	Not requested.
Institution Code Sequence	(0008,0082)	O	3	No/No	Not requested.
Issuer of Admission ID	(0038,0011)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Issuer of Admission ID Sequence	(0038,0014)	O	3	No/No	Not requested.
Service Episode ID	(0038,0060)	O	3	No/No	Not requested.
Issuer of Service Episode ID Sequence	(0038,0064)	O	3	No/No	Not requested.
Service Episode Description	(0038,0062)	O	3	No/No	Not requested.

4-4-5-2 Visit Status

TABLE 50 - VISIT STATUS MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Current Patient Location	(0038,0300)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Visit Status ID	(0038,0008)	O	3	No/No	Not requested.
Patient's Institution Residence	(0038,0400)	O	3	No/No	Not requested.
Visit Comments	(0038,4000)	O	3	No/No	Not requested.

4-4-5-3 Visit Relationship

No data elements are requested from the Visit Relationship Module.

4-4-5-4 Visit Admission

No data elements are requested from the Visit Admission Module.

4-4-6 Common Patient Entity Modules

4-4-6-1 Patient Relationship

No data elements are requested from the Patient Relationship Module.

4-4-6-2 Patient Identification

TABLE 51 - PATIENT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Patient's Name	(0010,0010)	R	1 *	Yes/Yes	Requested in the MWL queries. Matching is supported as follows: 1. No value is supplied (universal matching). 2. one value is supplied for matching (Single value matching). 3. Part of name with leading and trailing * (wild card matching). See *section 2.3.1.2.6.1 Associated Real-World Activity* for corresponding user's actions. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in answer, the SPS is accepted and the user will have to edit this value.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Patient ID	(0010,0020)	R	1 *	Yes/Yes	Requested in the MWL queries. Matching is supported as follows: 1. No value is supplied (universal matching) 2. one value is supplied for matching (Single value matching). If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in answer, the SPS is accepted and attribute will be created empty in images.
Issuer of Patient ID	(0010,0021)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	O	3	No/No	Not requested.
Other Patient IDs Sequence	(0010,1002)	O	3	No/No	Not requested.
Other Patient IDs	(0010,1000)	O	3	Yes/No	Requested in the MWL queries. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage. If absent or empty in answer, the SPS is accepted and attribute is not copied to images.
Other Patient Names	(0010,1001)	O	3	No/No	Not requested.
Patient's Birth Name	(0010,1005)	O	3	No/No	Not requested.
Patient's Mother's Birth Name	(0010,1060)	O	3	No/No	Not requested.
Referenced Patient Photo Sequence	(0010,1100)	O	3	No/No	Not requested.

NOTE: * In the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

4-4-6-3 **Patient Demographic**

TABLE 52 - PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Patients Birth Date	(0010,0030)	O	2 *	Yes/Yes	Requested in the MWL queries. If absent or empty in answer, the SPS is accepted and attribute is not copied to images. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage.
Patient's Sex	(0010,0040)	O	2 *	Yes/Yes	Requested in the MWL queries. If absent or empty in answer, the SPS is accepted and attribute is created empty in images. If value received in answer is not correct, it will be corrected (see *section 2.3.1.2.6.2.2 Record Acceptance Policy*) before usage.
Patient's Primary Language Code Sequence	(0010,0101)	O	3	No/No	Not requested.
Quality Control Subject	(0010,0200)	O	3	No/No	Not requested.
Patient's Size Code Sequence	(0010,1021)	O	3	No/No	Not requested.
Patient's Weight	(0010,1030)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Confidentiality constraint on patient data Description	(0040,3001)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Patient's Size	(0010,1020)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Patient's Address	(0010,1040)	O	3	No/No	Not requested.
Patient's Telephone Numbers	(0010,2154)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Patient's Age	(0010,1010)	O	3*	No/No	Not requested.
Occupation	(0010,2180)	O	3	No/No	Not requested.
Patient's Birth Time	(0010,0032)	O	3	No/No	Not requested.
Patient's Insurance Plan Code Sequence	(0010,0050)	O	3	No/No	Not requested.
Military Rank	(0010,1080)	O	3	No/No	Not requested.
Branch of Service	(0010,1081)	O	3	No/No	Not requested.
Country of Residence	(0010,2150)	O	3	No/No	Not requested.
Region of Residence	(0010,2152)	O	3	No/No	Not requested.
Patient's Telecom Information	(0010,2155)	O	3	No/No	Not requested.
Ethnic Group	(0010,2160)	O	3	No/No	Not requested.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Patient's Religious Preference	(0010,21F0)	O	3	No/No	Not requested.
Patient Comments	(0010,4000)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Responsible Person	(0010,2297)	O	3	No/No	Not requested.
Responsible Person Role	(0010,2298)	O	3	No/No	Not requested.
Responsible Organization	(0010,2299)	O	3	No/No	Not requested.
Patient Species Description	(0010,2201)	O	3	No/No	Not requested.
Patient Species Code Sequence	(0010,2202)	O	3	No/No	Not requested.
Patient Breed Description	(0010,2292)	O	3	No/No	Not requested.
Patient Breed Code Sequence	(0010,2293)	O	3	No/No	Not requested.
Breed Registration Sequence	(0010,2294)	O	3	No/No	Not requested.

NOTE: * indicates that this information is displayed on screen, if available.

4-4-6-4 Patient Medical

TABLE 53 - PATIENT MEDICAL MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Patient State	(0038,0500)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Pregnancy Status	(0010,21C0)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Medical Alerts	(0010,2000)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Allergies	(0010,2110)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Special Needs	(0038,0050)	O	2	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Pertinent Documents Sequence	(0038,0100)	O	3	No/No	Not requested.
Smoking Status	(0010,21A0)	O	3	No/No	Not requested.
Additional Patient History	(0010,21B0)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Last Menstrual Date	(0010,21D0)	O	3	No/No	Not requested.
Patient's Sex Neutered	(0010,2203)	O	3	No/No	Not requested.
Pertinent Resources Sequence	(0038,0101)	O	3	No/No	Not requested.
Patient Clinical Trial Participation Sequence	(0038,0502)	O	3	No/No	Not requested.

4-4-6-5 **Standard extended**

TABLE 54 – STANDARD EXTENDED IN THE MODALITY WORKLIST QUERY

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance / MPPS	Note
Study Description	(0008,1030)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted. NOTE: The study description in image is copied from Requested Procedure Description. See *Table 47*.
Name of Physician(s) Reading Study	(0008,1060)	O	3	No/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Operator's Name	(0008,1070)	O	3	Yes/Yes	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.
Implant Present	(0028,1300)	O	3	Yes/No	Requested in the MWL queries. If absent or empty in answer, SPS is accepted.

5 Modality Performed Procedure Step Implementation

5-1 Introduction

This section specifies the use of the DICOM Modality Performed Procedure Step information to be communicated to the Hospital/Radiology information system.

This feature works in conjunction with DICOM Modality Worklist feature, if installed. However the conformance of this feature is independent of Modality Worklist feature. For information on conformance of Modality Worklist feature to DICOM standard, refer to the appropriate section in this document.

5-2 Relationship between Scheduled and Performed Procedure Steps

Senographe Pristina supports one-to-one relationship, zero-to-one relationship (aka Unscheduled Case or Acquisition without MWL Data) , a one-to-multiple relationship (aka Append Case or Post-processing) between Scheduled Procedure Step and PPS.

5-3 Modality Performed Procedure Step Module Table

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

TABLE 55 - MODALITY PERFORMED PROCEDURE STEP MODULES

Module Name	Reference
SOP Common	*Section 5-4-1*
Performed Procedure Step Relationship	*Section 5-4-2*
Performed Procedure Step Information	*Section 5-4-3*
Image Acquisition Results	*Section 5-4-4*
Radiation Dose	*Section 5-4-5*
Billing and Material Management Codes	*Section 5-4-6*

5-4 Modality Performed Procedure Step Module Definitions

Refer to DICOM Standard PS 3.3. (Information Object Definitions) for a description of each of the attributes contained within the Modality Performed Procedure Step Information Object Definition.

5-4-1 SOP Common Module

TABLE 56 - SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Specific Character Set	(0008,0005)	1C	1C	If present, this tag is read from the image. Default value for this tag is “ISO_IR 100”.

5-4-2 Performed Procedure Step Relationship Module

MPPS IOD creator of the system reads the MPPS data to be sent from the composite. Modalities populate the MPPS attributes in the image.

TABLE 57 - PERFORMED PROCEDURE STEP RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	Acquisition without MWL Entry	Acquisition with MWL Entry
Scheduled Step Attributes Sequence	(0040,0270)	1, Only one item.	1
>Study Instance UID	(0020,000D)	1, Created by the modality.	1, Same as SPS. If received, else generated by modality.
>Referenced Study Sequence	(0008,1110)	2, Sent empty.	2, Same as SPS if the sequence is complete. (0008,1150) and (0008,1155) shall be present, else sent empty. Only 1 item.
>>Referenced SOP Class UID	(0008,1150)	1, Not Sent.	1, Same as SPS if present, else not sent.
>>Referenced SOP Instance UID	(0008,1155)	1, Not Sent.	1, Same as SPS if present, else not sent.
>Accession Number	(0008,0050)	2, User input on the modality if entered. Else sent empty.	2, Same as SPS if present else sent empty.
>Requested Procedure ID	(0040,1001)	2, Present and empty.	2, Same as SPS if present else sent empty.
>Requested Procedure Description	(0032,1060)	2, Present and empty.	2, Same as SPS if present, else sent empty.
>Scheduled Procedure Step ID	(0040,0009)	2, Sent empty.	2, Same as SPS if present, else sent empty.
>Scheduled Procedure Step Description	(0040,0007)	2, Copied if present, else empty.	2, Same as SPS if present, else sent empty.
>Scheduled Protocol Code Sequence	(0040,0008)	2, Sent empty.	2, Same as SPS if present else sent empty.
>>Code Value	(0008,0100)	1, Not Sent.	1, Same as SPS.
>>Coding Scheme Designator	(0008,0102)	1, Not Sent.	1, Same as SPS.
>>Coding Scheme Version	(0008,0103)	3, Not Sent.	3, Not sent.
>>Code Meaning	(0008,0104)	3, Not Sent.	3, Same as SPS if selected else sent empty.
Patient's Name	(0010,0010)	2, User input on the modality and equals to last name^middle^first name.	2, Same as SPS.
Patient ID	(0010,0020)	2, User input on the modality.	2, Same as SPS.
Patient's Birth Date	(0010,0030)	2, User input on the modality if entered else sent empty.	2, Same as SPS if present else sent empty.
Patient's Sex	(0010,0040)	2, User input on the modality if entered else sent empty.	2, Same as SPS if present else sent empty.

5-4-3 Performed Procedure Step Information Module

TABLE 58 - PERFORMED PROCEDURE STEP INFORMATION MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Performed Procedure Step ID	(0040,0253)	1	-	Unique string generated by the modality for entire session. It starts to 1 and be one unit incremented for each new PPS instance. It is reinitiated when the system reboots.
Performed Station AE Title	(0040,0241)	1	-	Local system's PPS SCU AE Title.
Performed Station Name	(0040,0242)	2	-	Local system's host-name.
Performed Location	(0040,0243)	2	-	Empty.
Performed Procedure Step Start Date	(0040,0244)	1	-	Same as date of first image.
Performed Procedure Step Start Time	(0040,0245)	1	-	Same as time of first image.
Performed Procedure Step Status	(0040,0252)	1	3	N-CREATE: Status is set to IN PROGRESS. N-SET: Status is set to COMPLETED or DISCONTINUED when the user manually interrupts the exam.
Performed Procedure Step Description	(0040,0254)	2	3	N-Create: Set to: For MPPS for 2D Raw: "2D MG for Processing". For MPPS for 2D Processed: "2D MG for Presentation". For MPPS for 3D Raw: "3D raw projections". For MPPS for 3D DBT volumes: "3D DBT Volumes". N-SET: Value is same as N-CREATE.
Performed Procedure Type Description	(0040,0255)	2	3	N-Create: Present and empty. N-Set: Absent.
Procedure Code Sequence	(0008,1032)	2	3	Left empty if performed procedure and requested procedure is different. Else copied from (0032,1064) when present in the MWL.
>Code Value	(0008,0100)	1	1	Copied from code value in (0032,1064) if present, else absent.
>Coding Scheme Designator	(0008,0102)	1	1	Copied from code scheme designator in (0032,1064) if present. Otherwise absent.
>Code Meaning	(0008,0104)	3	3	Copied from code meaning in (0032,1064) if present. Otherwise absent.
Performed Procedure Step End Date	(0040,0250)	2	3	N-CREATE: Empty. N-Set: Date when user chooses Complete or Discontinue action at close exam. For volume, set to date when volume is reconstructed.
Performed Procedure Step End Time	(0040,0251)	2	3	N-CREATE: Empty. N-Set: Time when user chooses Complete or Discontinue action. For volume, set to time when volume is reconstructed.
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3	3	N-Create: Present and empty. N-Set: Present if the procedure was discontinued.
>Code Value	(0008,0100)	1	1	Set to 110513.
>Coding Scheme Designator	(0008,0102)	1	1	Value set to "DCM".

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
>Code Meaning	(0008,0104)	3	3	Discontinued for unspecific reason.

5-4-4 Image Acquisition Results Module

TABLE 59 - IMAGE ACQUISITION RESULTS MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Modality	(0008,0060)	1	-	N-CREATE: Set to “MG”.
Study ID	(0020,0010)	2	-	Same as Exam number. N-CREATE: Copied from image.
Performed Protocol Code Sequence	(0040,0260)	2	3	Copied from image from Scheduled Protocol Code Sequence (0040,0008).
>Code Value	(0008,0100)	1	1	Copied from code value in (0040,0008).
>Coding Scheme Designator	(0008,0102)	1	1	Copied from code scheme designator in (0040,0008).
>Code Meaning	(0008,0104)	3	3	Copied from code meaning in (0040,0008).
Performed Series Sequence	(0040,0340)	2	3	N-CREATE: Sequence is present and empty. N-SET: Contains as many items as corresponding Dicom series acquired during exam.
>Performing Physician's Name	(0008,1050)	2	2	N-SET: Same as SPS, filled in by user or empty.
>Protocol Name	(0018,1030)	1	1	N-SET: The name of the protocol selected on the modality.
>Operator’s Name	(0008,1070)	2	2	N-Set: User input on the modality or retrieve from the SPS. Sent empty if not entered.
>Series Instance UID	(0020,000E)	1	1	N-SET: Series Instance UID of the referenced series.
>Series Description	(0008,103E)	2	2	N-SET: Series Description of the referenced series.
>Retrieve AE Title	(0008,0054)	2	2	N-SET: Sent empty.
>Referenced Image Sequence	(0008,1140)	2	2	N-SET: Present if Performed Series Sequence is present. Contains as many items as images in corresponding series. Each item contains a SOP Class UID / SOP Instance UID pair corresponding to the image. 1 item for each image created within the series.
>>Referenced SOP Class UID	(0008,1150)	1	1	N-SET: SOP Class UID of the created image.
>>Referenced SOP Instance UID	(0008,1155)	1	1	N-SET: SOP Instance UID of the created image.
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	2	2	Sent with zero items.
>>Referenced SOP Class UID	(0008,1150)	1	1	SOP Class UID of the created object.
>>Referenced SOP Instance UID	(0008,1155)	1	1	SOP Instance UID of the created object.

5-4-5 Radiation Dose Module

TABLE 60 – RADIATION DOSE MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Total Number Of Exposures	(0040,0301)	3	3	N-CREATE: Sent empty. N-SET: Present and filled in the N-SET corresponding to the first N-CREATE. Present and equals to zero for other N-SET. See *section 2.3.1.2.7* for the append mode implementation. Value is equal to the total number of exposure performed during exam. For PPS Append for DBT volumes, attribute is not sent.
Organ Dose	(0040,0316)	3	3	N-CREATE: Sent empty. N-SET: Always sent. Present and filled in, in the N-SET corresponding to the first N-CREATE of the exam. Present and equals to zero for other N-SET. Value is the sum of the "Organ Dose" for the 2D images, DBT sequences and organ doses of incompleted exams (repeated, rejected and aborted). Average organ dose value measured in dGy during the acquisition of the image. See *section 2.3.1.2.7* for the append mode implementation.
Entrance dose in mGy		3	3	N-CREATE: Present and empty N-SET: Present and filled in in the N-SET for raw images corresponding to the first N-Create. Value is the sum of 'Entrance dose in mGy" for the 2D images, DBT sequences and entrance dose of incompleted exam (repeated, rejected and aborted).

5-4-6 Billing and Material Management Codes Module

This module is not used.

5-5 Standard Extended and Private Data Attributes

None.

5-6 Standard Extended and Private Context Groups

None.

6 Storage Commitment Push Model implementation

6-1 Storage Commitment Push Model Information Object Definition

Refer to DICOM Part 3 (Information Object Definitions) for a description of each of the attributes contained within the Storage Commitment Information Object.

The Storage Commitment Information Object is used both for N-ACTION Storage Commitment Requests and N-EVENT-REPORT Storage Commitment Notifications by the SCU.

6-1-1 Storage Commitment Module for N-ACTION

TABLE 61 - STORAGE COMMITMENT MODULE FOR N-ACTION

Attribute Name	Tag	SCU Use
Transaction UID	(0008,1195)	Generated for each retry.
Storage Media File-Set ID	(0088,0130)	Not supported.
Storage Media File-Set UID	(0088,0140)	Not supported.
Referenced SOP Sequence	(0008,1199)	Sent with as many items as storage commitment request.
>Referenced SOP Class UID	(0008,1150)	SOP Class UID corresponding to image for which storage commit is requested.
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID corresponding to image for which storage commit is requested.
>Storage Media File-Set ID	(0088,0130)	Not supported.
>Storage Media File-Set UID	(0088,0140)	Not supported.

6-1-2 Storage Commitment Module for N-EVENT-REPORT

TABLE 62 - STORAGE COMMITMENT MODULE FOR N-EVENT-REPORT

Attribute Name	Tag	SCU Use
Transaction UID	(0008,1195)	Value received from SCP.
Retrieve AE Title	(0008,0054)	Not used.
Storage Media File-Set ID	(0088,0130)	Not used.
Storage Media File-Set UID	(0088,0140)	Not used.
Referenced SOP Sequence	(0008,1199)	When status is SUCCESS, the “Archived” flag value for the referenced SOP instances is changed to “Yes” in the browser. In case of partial failure, the archival status of a series is updated only if all the images of the series are archived successfully. Archive status of series is not updated if archiving of one or more images of the series failed.
>Referenced SOP Class UID	(0008,1150)	SOP Class UID corresponding to image for which storage is commited.
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID corresponding to image for which storage is commited.
>Retrieve AE Title	(0008,0054)	Set to the AET of the remote host.
>Storage Media File-Set ID	(0088,0130)	Not used.
>Storage Media File-Set UID	(0088,0140)	Not used.
Failed SOP Sequence	(0008,1198)	“Archived” flag value for the failed SOP instance is unaltered. Failed SOP instances are logged.

Attribute Name	Tag	SCU Use
>Referenced SOP Class UID	(0008,1150)	SOP Class UID corresponding to image for which storage is failed.
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID corresponding to image for which storage is failed.
>Failure Reason	(0008,1197)	Not used.

6-1-2-1 Processing of Failure Reason when received in a N-Event-Report

When receiving a N-Event-Report request with a Event Type ID equal to 2, meaning that Storage Commitment is complete, but failure exists. Following is the set of value that this Storage Commitment SCU AE is able to process.

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0110H	Processing failure	Log file updated: Processing Failure. Job failed.
0112H	No such object instance	Log file updated: No such object instance. Job failed.
0213H	Resource limitation	Log file updated: resource limitation. Job failed.
0122H	Referenced SOP Class not supported	Log file updated: reference SOP class not supported. Job failed.
0119H	Class/Instance conflict	Log file updated: class/instance conflict. Job failed.
0131H	Duplicate transaction UID	Log file updated: duplicate transaction UID. Job failed.
*	Other Failure Reason code values	Log file updated: unknown failure. Job failed.

7 Basic DICOM Directory Information Object Implementation

7-1 IOD Module Table

Table 63 identifies the defined modules within the entities which comprise the Basic Directory IOD. Modules are identified by Module Name.

See DICOM Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 63 - BASIC DIRECTORY IOD MODULES

Entity Name	Module Name	Reference
File Set Identification	File Set Identification	*Section 7-2-1*
Directory Information	Directory Information	*Section 7-2-2*

7-2 Information Module Definitions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Basic Directory Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

7-2-1 File Set Identification Module

TABLE 64 - FILE-SET IDENTIFICATION MODULE

Attribute Name	Tag	Type	Attribute Description
File-set ID	(0004,1130)	2	Set by application to DICOM DIR.

7-2-2 Directory Information Module

TABLE 65 - DIRECTORY INFORMATION MODULE

Attribute Name	Tag	Type	Attribute Description
Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	Set by application.
Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	Set by application.
File-set Consistency Flag	(0004,1212)	1	0000H: no known inconsistencies.
Directory Record Sequence	(0004,1220)	2	
>Offset of the Next Directory Record	(0004,1400)	1	Set by application.
>Record In-use Flag	(0004,1410)	1	FFFFH: record is in use.
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1	Set by application.
>Directory Record Type	(0004,1430)	1	PATIENT, STUDY, SERIES, IMAGE.
>Private Record UID	(0004,1432)	1C	Not supported.
>Referenced File ID	(0004,1500)	1C	Generated only for Image Directory Record, starting with A/Z01.

Attribute Name	Tag	Type	Attribute Description
>Referenced SOP Class UID in File	(0004,1510)	1C	Generated only for Image, Presentation and SR Document Directory Records.
>Referenced SOP Instance UID in File	(0004,1511)	1C	Generated only for Image, Presentation and SR Document Directory Records. Set to SOP Instance UID (0008,0018) during save to media.
>Referenced Transfer Syntax UID in File	(0004,1512)	1C	Generated only for Image, Presentation and SR Document Directory Records.
>Referenced Related General SOP Class UID in File	(0004,151A)	1C	Not supported.
>Record Selection Keys	N/A	N/A	DICOM Data Elements that contain specific keys defined for each type of Directory Record (0004,1430). See 7-2-3 for Additional Keys per Application Profiles.

7-2-3 Definition of Specific Directory Records

7-2-3-1 Patient Directory Record Definition

TABLE 66 - PATIENT RECORD KEYS

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Specific Character Set	(0008,0005)	1C	1C	ISO_IR 100.
Patient's Name	(0010,0010)	2	2	If present in composite object instances, it will be set to same value. Otherwise, not present.
Patient ID	(0010,0020)	1	1	If present in composite object instances, it will be set to same value. Otherwise, not present.
Patient Birth Date	(0010,0030)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Patient Birth Time	(0010,0032)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Patient Sex	(0010,0040)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.

NOTE: E represents Standard Extended Element.

7-2-3-2 Study Directory Record Definition

TABLE 67 - STUDY RECORD KEYS

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Specific Character Set	(0008,0005)	1C	1C	ISO_IR 100.
Study Date	(0008,0020)	1	1	If present in composite object instances, it will be set to same value. Otherwise, computed.
Study Time	(0008,0030)	1	1	If present in composite object instances, it will be set to same value. Otherwise, computed.
Study Description	(0008,1030)	2	2	If present in composite object instances, it will be set to same value. Otherwise, not present.
Study Instance UID	(0020,000D)	1C	1C	This is set to value that is present in the composite object instances. Otherwise, composite object instances are not archived.

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Study ID	(0020,0010)	1	1	If present in composite object instances, it will be set to same value.
Accession Number	(0008,0050)	2	2	If present in composite object instances, it will be set to same value. Otherwise, not present.

7-2-3-3 Series Directory Record Definition

TABLE 68 - SERIES RECORD KEYS

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Specific Character Set	(0008,0005)	1C	1C	ISO_IR 100.
Modality	(0008,0060)	1	1	If present in composite object instance, it will be set to same value. Otherwise, an error is returned and the object not put on media.
Series Instance UID	(0020,000E)	1	1	This is set to value that is present in the composite object instance. Otherwise, check for presence of Referenced SOP Instance UID in File (0004,1511). If both not present, instance is not put on media.
Series Number	(0020,0011)	1	1	If present in composite object instance, it will be set to same value. Otherwise, computed.
Icon Image Sequence	(0088,0200)	3	3	Not supported.
Manufacturer	(0008,0070)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Manufacturer's Model Name	(0008,1090)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Performing Physician's Name	(0008,1050)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Institution Name	(0008,0080)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Institution Address	(0008,0081)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Image Type	(0008,0008)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.

NOTE: E represents Standard Extended Element.

7-2-3-4 Image Directory Record Definition

TABLE 69 - IMAGE RECORD KEYS

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Specific Character Set	(0008,0005)	1C	1C	ISO_IR 100 or GB18030 or ISO 2022 IR 13\ISO 2022 IR 87.
SOP Instance UID	(0008, 0018)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Acquisition Time	(0008, 0032)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Acquisition Datetime	(0008,002A)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Image Type	(0008,0008)	1C	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Referenced Image Sequence	(0008,1140)	1C	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Sequence Variant	(0018,0021)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Slice Thickness	(0018,0050)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Repetition Time	(0018,0080)	E	E	If present in composite object instances it will be set to same value. Otherwise not present.
Echo Time	(0018,0081)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Inversion Time	(0018,0082)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Number of Averages	(0018,0083)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Echo Number	(0018,0086)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Spacing between slices	(0018,0088)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Data Collection Diameter	(0018,0090)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Contrast/Bolus Route	(0018,1040)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Trigger Time	(0018,1060)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Reconstruction Diameter	(0018,1100)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Gantry/Detector Tilt	(0018,1120)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Convolution Kernel	(0018,1210)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Flip Angle	(0018,1314)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Acquisition Time Synchronized	(0018,1800)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Instance Number	(0020,0013)	1	1	If present in composite object instance, it will be set to same value. Otherwise, computed.
Image Position (Patient)	(0020,0032)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Image Orientation (Patient)	(0020,0037)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Frame of Reference UID	(0020,0052)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Slice Location	(0020,1041)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Synchronization Frame of Reference UID	(0020,0200)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.

Key	Tag	Type (for CD)	Type (for DVD / USB)	Attribute Description
Rows	(0028,0010)	E	1	If present in composite object instances, it will be set to same value. Otherwise, not present.
Columns	(0028,0010)	E	1	If present, in composite object instances it will be set to same value. Otherwise, not present.
Pixel Spacing	(0028,0030)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Number of Frames	(0028,0008)	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Lossy Image Compression Ratio	(0028,2112	E	1C	If present in composite object instances, it will be set to same value. Otherwise, not present.
Calibration Image	(0050,0004)	E	1C	Not used.
Units	(0054,1001)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Attenuation Correction Method	(0054,1101)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.
Reconstruction Method	(0054,1103)	E	E	If present in composite object instances, it will be set to same value. Otherwise, not present.

NOTE: E represents Standard Extended Element.

7-2-3-5 Presentation Directory Record Definition

Not supported.

7-2-3-6 Structured Report Directory Record Definition

Not supported.

7-2-3-7 Private (GEMS PET Raw) Directory Record Definition

Not supported.

8 PRINT Management Implementation

8-1 Introduction

This section of the DICOM Conformance Statement specifies the implementation for the specific SOP Classes supported in the Basic Grayscale and Color Print Management Meta SOP Classes, the attributes supported for both IODs and services, and the valid range of values for mandatory and optional attributes.

8-2 Basic Film Session SOP Class

8-2-1 Basic Film Session N-Create Attributes

The following table lists the attributes that are sent in the Basic Film Session N-CREATE Request:

TABLE 70 – BASIC FILM SESSION N-CREATE ATTRIBUTES

Attribute name	Tag	Use
Specific Character Set	(0008,0005)	Not used.
Number of Copies	(2000,0010)	Set by user. Valid range is: 1-99.
Medium Type	(2000,0030)	Set when a printer device is added using the Filmer Tool. Valid values are: “PAPER” or “CLEAR FILM” or “BLUE FILM” or “CLEAR” or “MAMMO CLEAR FILM” or “MAMMO BLUE FILM”.
Film Destination	(2000,0040)	Set when a printer device is added using the Filmer Tool. Valid values are: “MAGAZINE” or “PROCESSOR” or values starting with “BIN_”.
Film Session Label	(2000,0050)	Set when a printer device is added using the Filmer. All strings supported except EMPTY.
Memory Allocation	(2000,0060)	Used. Amount of memory allocated for the film session. Value is expressed in KB.
Owner ID	(2100,0160)	Not used.

8-3 Basic Film Box SOP Class

8-3-1 Basic Film Box N-Create Attributes

The following table lists the attributes that are sent to the SCP in the Basic Film Box N-Create Request, and that are received in the Basic Film Box N-Create Response from the SCP:

TABLE 71 – BASIC FILM BOX N-CREATE ATTRIBUTES

Attribute Name	Tag	Use
Image Display Format	(2010,0010)	Set in User Interface. Valid Range: STANDARD\C,R.
Referenced Film Session Sequence	(2010,0500)	Sent in the request.
>Referenced SOP Class UID	(0008,1150)	Film session SOP Class UID (1.2.840.10008.5.1.1.1).
>Referenced SOP Instance UID	(0008,1155)	Film session SOP instance UID.
Referenced Image Box Sequence	(2010,0510)	Used in Image Box N-SET request.
>Referenced SOP Class UID	(0008,1150)	1.2.840.10008.5.1.1.4
>Referenced SOP Instance UID	(0008,1155)	Image Box SOP instance UID.

Attribute Name	Tag	Use
Film Orientation	(2010,0040)	Set when a printer device is added using the Film Tool. Valid value is: “PORTRAIT” or “LANDSCAPE”.
Film Size ID	(2010,0050)	Set when a printer device is added using the Film Tool. Valid values are: “14INX17IN” “8INX10IN” “10INX12IN” “10INX14IN” “11INX14IN” “14INX14IN” “24CMX24CM” “24CMX30CM”
Magnification Type	(2010,0060)	Set when a printer device is added using the Film Tool. Valid values are: “REPLICATE” “BILINEAR” “CUBIC” “NONE”
Max Density	(2010,0130)	Set when a printer device is added using the Film Tool. Valid range is: 0-4095.
Configuration Information	(2010,0150)	Set when a printer device is added using the Film Tool.
Annotation Display Format ID	(2010,0030)	Not Supported.
Smoothing Type	(2010,0080)	Set when a printer device is added using the Film Tool. Only valid for Magnification Type (2010,0060) = CUBIC.
Border Density	(2010,0100)	Set when a printer device is added using the Film Tool. Valid values are: “BLACK” or “WHITE” or “Not sent”.
Empty Image Density	(2010,0110)	Not used. Set when a printer device is added using the Film Tool. Valid values are: “BLACK” or “WHITE” or “Not sent”.
Min Density	(2010,0120)	Not Supported.
Trim	(2010,0140)	Valid values are: “YES” or “NO” or “Not Sent”.
Illumination	(2010,015E)	Not Supported.
Reflected Ambient Light	(2010,0160)	Not Supported.
Requested Resolution ID	(2020,0050)	Not Supported.
ICC Profile	(0028,2000)	Not Supported.

8-3-2 Basic Film Box N-Action Attributes

Following are the Action reply arguments that are supported if present in the N-Action response of the Basic Film Box SOP Class:

TABLE 72 – BASIC FILM BOX N-ACTION ATTRIBUTES

Action Type Name	Action Type ID	Attribute	Tag	Usage SCU
Print	1	Referenced Print Job Sequence	(2100,0500)	Ignored.
		>Referenced SOP Class UID	(0008,1150)	Ignored.
		>Referenced SOP Instance UID	(0008,1155)	Ignored.

Action Type Name	Action Type ID	Attribute	Tag	Usage SCU
		>Print Job ID	(2100,0010)	Not supported.

8-3-3 Basic Film Box N-Delete

The DICOM SERVER AE requests the Print SCP to delete the Film Box Instance.

8-4 Basic Grayscale Image Box SOP Classes

8-4-1 Basic Grayscale Image Box Pixel N-Set Attributes

The following table lists the attributes that are sent in the Basic Grayscale Image Box N-Set Request:

TABLE 73 – BASIC GRAYSCALE IMAGE BOX PIXEL N-SET ATTRIBUTES

Attribute Name	Tag	Use
Image Box Position	(2020,0010)	Based on Image Display Format.
Basic Grayscale Image Sequence	(2020,0110)	Sent in the request.
>Samples Per Pixel	(0028,0002)	1.
>Photometric Interpretation	(0028,0004)	MONOCHROME2.
>Rows	(0028,0010)	Image Dependent.
>Columns	(0028,0011)	Image Dependent.
>Pixel Aspect Ratio	(0028,0034)	Image Dependent. Not sent if aspect ratio is 1\1.
>Bits Allocated	(0028,0100)	8 (if Bits Stored=8) or 16 (if Bits Stored=12).
>Bits Stored	(0028,0101)	8 or 12.
>High Bit	(0028,0102)	7 (if Bits Stored=8) or 11 (if Bits Stored=12).
>Pixel Representation	(0028,0103)	0 (unsigned integer).
>Pixel Data	(7FE0,0010)	Pixel data. Required.
Magnification Type	(2010,0060)	Not used.
Smoothing Type	(2010,0080)	Not used.
Min Density	(2010,0120)	Not used.
Max Density	(2010,0130)	Not used.
Configuration Information	(2010,0150)	Not used.
Requested Image Size	(2020,0030)	Not used.
Requested Decimate/Crop Behavior	(2020,0040)	Not used.
Referenced Presentation LUT Sequence	(2050,0500)	Not supported.
>Referenced SOP Class UID	(0008,1150)	Not supported.
>Referenced SOP Instance UID	(0008,1155)	Not supported.

8-5 Printer SOP Class

8-5-1 Printer N-Event-Report Attributes

If an N-EVENT-REPORT DIMSE service is received when the association is active, the DICOM SERVER AE handles the relevant states, but the received data is ignored.

8-5-2 Printer N-Get Attributes

N-Get request is sent when the user initiates the print activity by clicking on the Print button. Based on the N-Get response, the DICOM SERVER AE continues to send the Film Session's N-CREATE request if status is NORMAL, else pauses the print job and displays the error message on the Film Job Manager UI.

The following table defines the set of attributes that this product may request using the Printer N-Get service. It also describes what is the product behavior when receiving the N-Get response from the Printer SCP.

TABLE 74 – PRINTER N-GET ATTRIBUTES

Attribute Name	Tag	Use
Printer Status	(2110,0010)	NORMAL: Status is logged and sends Film Session N-CREATE request. WARNING: Status is logged. and sends Film Session N-CREATE request. FAILURE: Status is logged. Fails the print job and displays print failure message on the Job Manager UI.
Printer Status Info	(2110,0020)	Logs the message and if Printer Status is WARNING, it will continue printing. If Printer Status is Failure, it will fail the Print Job.
Printer Name	(2110,0030)	Logged if sent by SCP.
Manufacturer	(0008,0070)	Logged if sent by SCP.
Manufacturer Model Name	(0008,1090)	Logged if sent by SCP.
Device Serial Number	(0018,1000)	Logged if sent by SCP.
Software Versions	(0018,1020)	Logged if sent by SCP.
Date Of Last Calibration	(0018,1200)	Ignored.
Time Of Last Calibration	(0018,1201)	Ignored.

9 Digital Mammography X-ray Information Object Implementation

9-1 Introduction

This section specifies the use of the DICOM Digital Mammography X-ray (MG) Image IOD to represent the information included in MG images produced by this implementation. Corresponding attributes are conveyed using the module construct.

9-2 MG IOD Implementation

The MG Image IOD is used in 2 SOP classes as defined in PS3.4 Storage Service Class, a SOP Class for storage of images intended for presentation, and a SOP class for storage of images intended for further processing before presentation. These are distinguished by their SOP Class UID and by the Enumerated Value of the mandatory Attribute in DX Series Module, Presentation Intent Type (0008,0068).

For Senographe Pristina 3D and Pristina Serena 3D only: Within a 3D exam, the MG Image IOD is used to describe the acquired source images: Projections. Each projection is stored as Digital Image For Processing that can be distinguished by its SOP Class UID and the mandatory attribute Image type (0008,0008).

9-3 MG Entity-Relationship Model

The Entity-Relationship diagram for the MG Image interoperability schema is shown in Figure 4. In this figure, the following diagrammatic convention is established to represent the information organization:

• each entity is represented by a rectangular box.

• each relationship is represented by a diamond shaped box.

• the fact that a relationship exists between 2 entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Patient for each Study (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

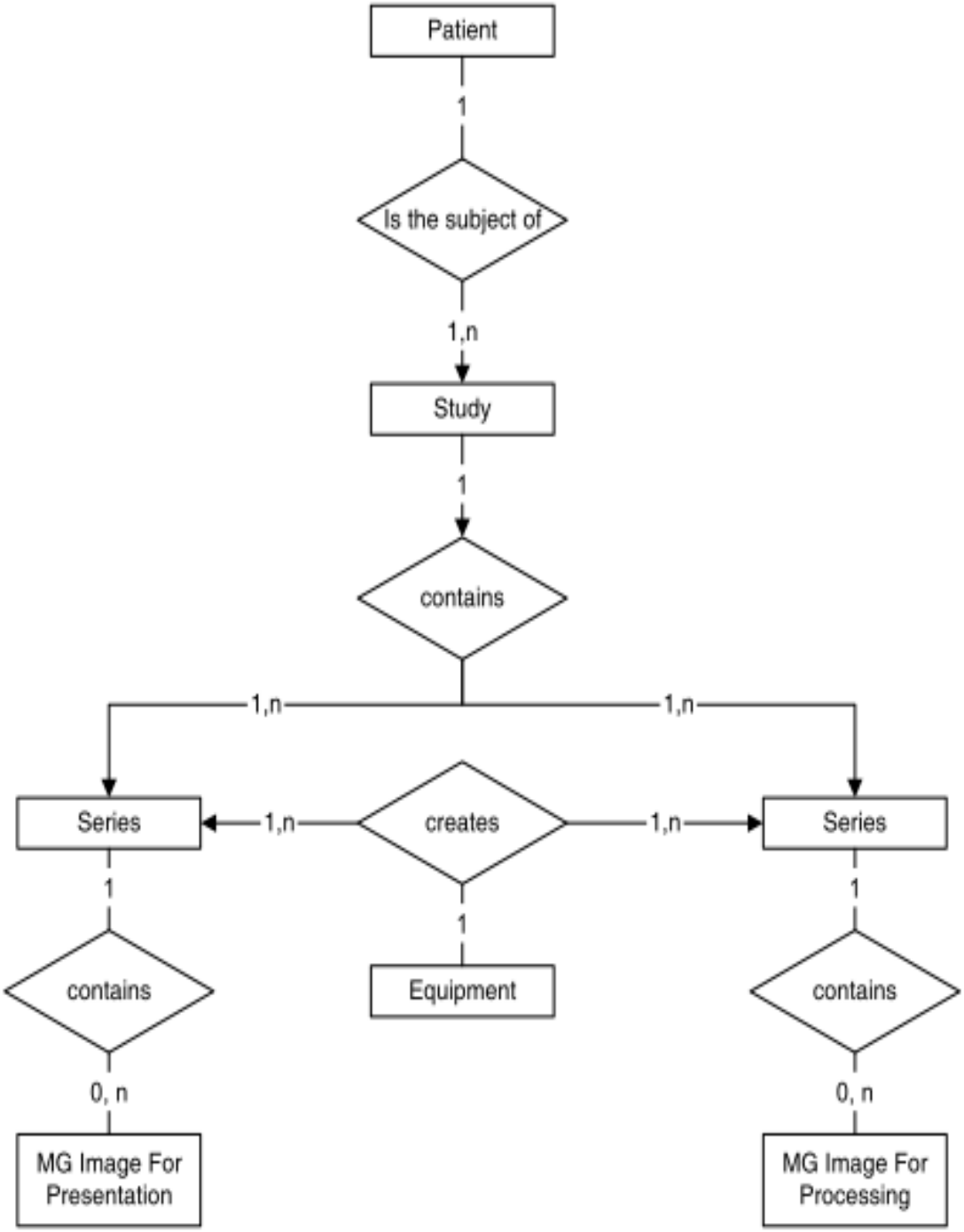


FIGURE 4 - MG IMAGE ENTITY RELATIONSHIP DIAGRAM.

9-3-1 Entity Descriptions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the MG Information Object.

9-3-2 Senographe Pristina Acquisition Workstation Mapping of DICOM entities

TABLE 75 - MAPPING OF DICOM ENTITIES TO SENOGRAPHE PRISTINA ENTITIES

DICOM	Senographe Pristina Entity
Patient	Patient
Study	Study
Series	Series
Image	Image
Frame	Frame

9-4 IOD Module Table

Within an entity of the DICOM MG IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets. Table 76 identifies the defined modules within the entities which comprise the DICOM MG IOD. Modules are identified by Module Name. See DICOM Part 3.

TABLE 76 - MG IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Table 77 – Patient Module Attributes
Study	General Study	Used	Table 78 – General Study Module Attributes
	Patient Study	Used	Table 79 – Patient Study Module Attributes
Series	General Series	Used	Table 80 – General Series Module Attributes
	DX Series	Used	Table 81 – DX Series Module Attributes
	Mammography Series	Used	Table 82 – Mammography Series Module Attributes
Frame of Reference	Frame of Reference	Used only in 3D, CESM and Biopsy.	Table 83 – Frame Of Reference Module Attributes
Equipment	General Equipment	Used	Table 84 – General Equipment Module Attributes
Image	General Image	Used	Table 85 – General Image Module
	Image Pixel	Used	Table 88 – Image Pixel Module Attributes
	Display Shutter	Used only in 3D.	Table 89 – Display Shutter Module Attributes
	X-Ray Filtration	Used	Table 92 – X-Ray Filtration Module Attributes
	X-Ray Acquisition Dose	Used	Table 90 – X-Ray Acquisition Dose Module Attributes
	X-Ray Generation	Used	Table 91 – X-Ray Generation Module Attributes
	X-Ray Grid	Used	Table 93 – X-Ray Grid Module Attributes
	DX Anatomy Imaged	Used	Table 94 – DX Anatomy Imaged Module Attributes
	DX Image	Used	Table 95 – DX Image Module Attributes
	Mammography Image	Used	Table 99 – Mammography Image Module Attributes
	DX Detector	Used	Table 96 – DX Detector Module Attributes
	X-Ray Collimator	Used	Table 97 – X-Ray Collimator Module Attributes
	DX Positioning	Used	Table 98 – Dx Positioning Module Attributes
	Acquisition Context	Used	Table 100 – Acquisition Context Module Attributes
	VOI LUT	Used	Table 101 – VOI LUT Module Attributes
	SOP Common	Used	Table 102 – SOP Common Module Attributes
	Contrast Bolus	Used only in CESM	Table 103 – Contrast Bolus Module Attributes
Private Module	Application module	Used	Table 104 – Application Module Attributes

9-5 Information Module Definitions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Digital Mammography X-ray Information Object. The following modules are included to convey Supported Values and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Attributes not enclosed in the following modules are not generated by the system and are ignored when received from a remote host.

9-5-1 Common Patient Entity Modules

9-5-1-1 Patient Module

TABLE 77 – PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Patient's Name	(0010,0010)	2	The value is retrieved from HIS/RIS or entered by the user on the application.
Patient ID	(0010,0020)	2	The value is retrieved from HIS/RIS or entered by the user on the application.
Patient's Birth date	(0010,0030)	2	The value is retrieved from HIS/RIS or entered by the user on the application.
Patient Sex	(0010,0040)	2	The value is retrieved from HIS/RIS or entered by the user on the application.
Other Patient IDs	(0010,1000)	3	The value is retrieved from HIS/RIS or attribute not sent otherwise.

9-5-2 Common Study Entity Modules

9-5-2-1 General Study Module

TABLE 78 – GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Study Instance UID	(0020,000D)	1	The value is retrieved from HIS/RIS or generated by the system.
Study Date	(0008,0020)	2	The value is set to current date when generating a new study.
Study Time	(0008,0030)	2	The value is set to current time when generating a new study.
Referring Physician's Name	(0008,0090)	2	The value is retrieved from HIS/RIS or entered by the user on the application.
Study ID	(0020,0010)	2	The value is retrieved from HIS/RIS, using information in Requested Procedure ID (0040, 1001). If Study ID is missing in the SPS from RIS, value is filled with "#"
Accession Number	(0008,0050)	2	The value is retrieved from HIS/RIS or entered by the user using the application.
Study Description	(0008,1030)	3	The value is retrieved from HIS/RIS using information in Procedure description attribute (0032, 1060), or entered by the user on the application.
Referenced Study Sequence	(0008,1110)	3	The value is retrieved from the HIS/RIS or attribute is not sent otherwise.

Attribute Name	Tag	Type	Use
>Referenced SOP Class UID	(0008,1150)	1	The value is retrieved from the HIS/RIS or attribute is not sent otherwise.
>Referenced SOP Instance UID	(0008,1155)	1	The value is retrieved from the HIS/RIS or attribute is not sent otherwise.
Procedure Code Sequence	(0008,1032)	3	The value is retrieved from the HIS/RIS or attribute is not sent otherwise. If sequence is received incomplete, it will be corrected as described below in sequence elements.
>Code Value	(0008,0100)	1C	The value is from the HIS/RIS or attribute is not sent otherwise. If missing in sequence, copied with code meaning.
>Coding Scheme Designator	(0008,0102)	1C	The value is retrieved from the HIS/RIS or attribute is not sent otherwise. If missing in sequence, value is set to ”99LOCAL”.
>Code Meaning	(0008,0104)	1	The value is retrieved from the HIS/RIS or attribute is not sent otherwise. If missing in sequence, value is set to the code value.

9-5-2-2 Patient Study Module

TABLE 79 – PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Patient’s age	(0010,1010)	3	The value is generated by the system when the patient’s birth date (0010,0030) is provided.

9-5-3 Common Series Entity Modules

9-5-3-1 General Series Module

TABLE 80 – GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	1	Value is set to “MG”.
Series Instance UID	(0020,000E)	1	Unique identifier of the Series. UID generated by the system.
Series Number	(0020,0011)	2	Number is generated by the system.
Series Date	(0008,0021)	3	The value is set to current date when generating a new series.
Series Time	(0008,0031)	3	The value is set to current time when generating a new series.
Performing Physicians’ Name	(0008,1050)	3	The value is loaded from HIS/RIS, using information in Scheduled Performing Physician’s Name (0040, 0006) or is entered/updated by the user using the Medical Procedure Card.

Attribute Name	Tag	Type	Use
Protocol Name	(0018,1030)	3	Value is one of: - "ROUTINE" for 2D images acquired in Routine medical procedure. - "3D_ROUTINE" for DBT projections and volumes acquired in 3D medical procedure - “CESM” for images acquired in Routine CESM medical procedure - “3D_ROUTINE+2D_ROUTINE” for 2D images, DBT projections and volumes acquired in 3D+2D medical procedure - “STEREO” for images acquired in 2D Biopsy medical procedure - “3D_BIOPSY” for DBT projections and volumes acquired in 3D Biopsy medical procedure - “SAMPLE” for specimen imaging - “CESM_BIOPSY” for images acquired in CESM Biopsy
Series Description	(0008,103E)	3	Value in 2D images = <Procedure>_<ImageType>_<ViewName> Where: <Procedure> = 2D / 3D / CESM / 2D_BIOPSY / 3D_BIOPSY / SAMPLE / CESM_BIOPSY <ImageType> = RAW / PROC / PROJ <ViewName> = content of (0045,101B) <ViewName> is applicable for 3D, CESM, 2D_BIOPSY and 3D_BIOPSY procedures. <Viewname> only contains laterality for SAMPLE procedure. Value in 3D DBT volumes = <Procedure>_<ImageType>_<ViewName> Where: Procedure = ROUTINE3D / 3D_BIOPSY ImageType = VOL in BTO / PLANES or SLABS in CTO view name = value from projections (0045,101B)
Operators' Name	(0008,1070)	3	The value is loaded from HIS/RIS, using information in Operator’s Name (0008, 1070) or is entered/updated by the user on the application.
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Uniquely identifies the Performed Procedure Step SOP Instance to which the Series is related. Present only for images acquired when a PPS manager is declared.
>Referenced SOP Class UID	(0008,1150)	1	Value is set to 1.2.840.10008.3.1.2.3.3.
>Referenced SOP Instance UID	(0008,1155)	1	MPPS SOP instance UID generated by the system at acquisition.
Body Part Examined	(0018,0015)	3	Value is set to “BREAST”. Not present for specimen images.
Patient Position	(0018,5100)	2C	Sent empty in CTO volumes. Not sent otherwise.
Request Attributes Sequence	(0040,0275)	3	Contains attributes from the Imaging Service Request. The sequence may have one or more Items. This information is present only if retrieved from HIS/RIS.
>Requested Procedure ID	(0040,1001)	1C	Identifier of the Requested Procedure in the Imaging Service Request. This information is present only if retrieved from HIS/RIS.
>Requested Procedure Description	(0032,1060)	3	This information is present only if retrieved from HIS/RIS.

Attribute Name	Tag	Type	Use
>Scheduled Procedure Step ID	(0040,0009)	1C	Identifier of the Scheduled Procedure Step. This information is present only if retrieved from HIS/RIS.
>Scheduled Procedure Step Description	(0040,0007)	3	Institution-generated description or classification of the Scheduled Procedure Step to be performed. This information is present only if retrieved from HIS/RIS.
>Scheduled Protocol Code Sequence	(0040,0008)	3	Sequence describing the Scheduled Protocol following a specific coding scheme. This sequence contains one or more items and is present only if retrieved from HIS/RIS. If sequence is received incomplete, it will be corrected as described below in sequence elements.
>>Code Value	(0008,0100)	1C	This information is present only if retrieved from HIS/RIS. If missing in the sequence, will have the code meaning instead.
>>Coding Scheme Designator	(0008,0102)	1C	This information is present only if retrieved from HIS/RIS. If missing in the sequence, value is set to "99LOCAL".
>>Code Meaning	(0008,0104)	1	This information is present only if retrieved from HIS/RIS. If missing in the sequence, will have the code value instead.
Performed Procedure Step ID*	(0040,0253)	3	Order number automatically generated by the system.
Performed Procedure Step Start Date*	(0040,0244)	3	Date on which the Referenced Performed Procedure Step (0008,1111) was started.
Performed Procedure Step Start Time*	(0040,0245)	3	Time on which the Referenced Performed Procedure Step (0008,1111) was started.
Performed Procedure Step Description*	(0040,0254)	3	Value set to: - "2D MG for Processing" for 2D Raw image - "2D MG for Presentation" for 2D Processed image - "3D raw projections" for 3D Raw projections - "3D DBT Volumes" for volumes The value is sent only for images acquired when a PPS manager is declared.

NOTE: All items marked by an asterisk are present in the generated images only if they are referenced by an associated MPPS SOP instance.

9-5-3-2 DX Series Module

TABLE 81 – DX SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	1	Described in General Series Module.
Referenced Performed Procedure Step Sequence	(0008,1111)	1C	Described in General Series Module.
>Referenced SOP Class UID	(0008,1150)	1C	Described in General Series Module.
>Referenced SOP Instance UID	(0008,1155)	1C	Described in General Series Module.
Presentation Intent Type	(0008,0068)	1	Value set to: - "FOR PROCESSING" for raw image - "FOR PRESENTATION" for processed image.

9-5-3-3 Mammography Series Module

TABLE 82 – MAMMOGRAPHY SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Described in General Series Module.
Request Attributes Sequence	(0040,0275)	3	Described in General Series Module.
>Scheduled Procedure Step Description	(0040,0007)	3	Described in General Series Module.

Attribute Name	Tag	Type	Attribute Description
>Scheduled Protocol Code Sequence	(0040,0008)	1C	Described in General Series Module.
>Scheduled Procedure Step ID	(0040,0009)	1C	Described in General Series Module.
>Requested Procedure ID	(0040,1001)	1C	Described in General Series Module.

9-5-4 Frame of Reference Entity Modules

9-5-4-1 Frame of Reference Module

The Frame Of Reference module is present in Composite Image IODs generated by the system for 3D, CESM and Biopsy procedures.

TABLE 83 – FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Frame of Reference UID	(0020,0052)	1	Same frame of reference UID for all images acquired under the same breast compression. After compression is released a new frame of reference UID is generated by the system. Not sent for specimen images.
Position Reference Indicator	(0020,1040)	2	Sent empty. Not sent for specimen images.

9-5-5 Common Equipment Entity Modules

9-5-5-1 General Equipment Module

TABLE 84 – GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Manufacturer	(0008,0070)	2	Value is set to “GE HEALTHCARE”.
Institution Name	(0008,0080)	3	Value is copied from the system configuration.
Institution Address	(0008,0081)	3	Value is copied from the system configuration.
Station Name	(0008,1010)	3	Value is set to hostname of the workstation generating the object.
Institutional Department Name	(0008,1040)	3	Value is copied from the system configuration.
Manufacturer's Model Name	(0008,1090)	3	Value is set to “Senographe Pristina”.
Device Serial Number	(0018,1000)	3	Value is set to MAC address of the Axis workstation.
Software Versions	(0018,1020)	3	Value is set to: - Axis software release for 2D images - “Reconstruction Package VERSION RECON_<reconstruction_box_software_version>" for 3D volumes
Pixel Padding Value	(0028,0120)	1C	Value is sent in processed image and 3D volumes.

9-5-6 Common Image Entity Modules

9-5-6-1 General Image Module

TABLE 85 – GENERAL IMAGE MODULE

Attribute Name	Tag	Type	Use
Instance Number	(0020,0013)	2	First image acquired for the series: value is 1. One unit incrementing for each new acquired image in the series. - For the DBT projections, value corresponds to the projection number, starting with 1 for the first acquired projection.
Patient Orientation	(0020,0020)	2C	The value depends on the image view selected by the user. Not sent for specimen images.
Content Date	(0008,0023)	2C	For Processing image, Image date&Time = Acquisition Date&Time. For Presentation image, Image Date&Time is later than Acquisition Date&Time.
Content Time	(0008,0033)	2C	For Processing image, Image Date&Time= Acquisition Date&Time. For Presentation Image, Date&Time is later than Acquisition Date&Time.
Image Type	(0008,0008)	3	The Image Type attribute is a multi-valued attribute. See *Table 86 – Image Type* for details of possible values.
Acquisition Date	(0008,0022)	3	Value is set by the system when image is acquired.
Acquisition Time	(0008,0032)	3	Value is set by the system when image is acquired.
Source Image Sequence	(0008,2112)	3	Value is present only in For Presentation image.
>Referenced SOP Class UID	(0008,1150)	1C	Value is set to the MG FOR PROCESSING SOP class. UID:1.2.840.10008.5.1.4.1.1.1.2.1.
>Referenced SOP Instance UID	(0008,1155)	1C	For Routine 2D "For Presentation" images: Set to the SOP instance UID of the MG for processing SOP instance that was used to generate the related composite SOP instance.
>Spatial Location Preserved	(0028,135A)	3	Value is set to "YES".
Images in Acquisition	(0020,1002)	3	For DBT projections, set to the number of projections for this DBT acquisition.
Quality Control Image	(0028,0300)	3	Value is set to “NO”.
Burned In Annotation	(0028,0301)	3	Value is set to “NO”.
Lossy Image Compression	(0028,2110)	3	Value is set to “00”.
Icon Image Sequence	(0088,0200)	3	Value is sent.
>Samples per Pixel	(0028,0002)	1	Value is set to 1.
>Photometric Interpretation	(0028,0004)	1	Value is set to “MONOCHROME2”.
>Rows	(0028,0010)	1	Value is <= 64.
>Columns	(0028,0011)	1	Value is <= 64.
>Bits Allocated	(0028,0100)	1	Value is set to 8.
>Bits Stored	(0028,0101)	1	Value is set to 8.
>High Bit	(0028,0102)	1	Value is set to 7.
>Pixel Representation	(0028,0103)	1	Value is set to 0000H (unsigned integer).
>Pixel Data	(7FE0,0010)	1	Value is sent.
Referenced Image Sequence	(0008,1140)	3	Reference other images in the biopsy pair (stx+ and stx-) and corresponding scout.
>Referenced SOP Class UID	(0018,1150)	1	
>Referenced SOP Instance UID	(0018,1155)	1	

TABLE 86 – IMAGE TYPE

Application	Image	Image Type (0008,0008)
2D Routine	Raw	ORIGINAL\PRIMARY\
	Processed	DERIVED\PRIMARY\
	Re-processed	DERIVED\SECONDARY\
2D CESM	Raw low energy	ORIGINAL\PRIMARY\POST_CONTRAST\LOW_ENERGY\LOW_ENERGY
	Processed low energy	DERIVED\PRIMARY\POST_CONTRAST\LOW_ENERGY\LOW_ENERGY
	Re-processed low energy	DERIVED\SECONDARY\POST_CONTRAST\LOW_ENERGY\LOW_ENERGY
	Raw high energy	ORIGINAL\PRIMARY\POST_CONTRAST\HIGH_ENERGY\HIGH_ENERGY
	Recombined	DERIVED\PRIMARY\POST_CONTRAST\SUBTRACTION\\RECOMBINED
	Re-recombined	DERIVED\SECONDARY\POST_CONTRAST\SUBTRACTION\\RECOMBINED
2D Biopsy	Raw scout	ORIGINAL\PRIMARY\STEREO_SCOUT
	Processed scout	DERIVED\PRIMARY\STEREO_SCOUT
	Raw stx+	ORIGINAL\PRIMARY\STEREO_PLUS
	Processed stx+	DERIVED\PRIMARY\STEREO_PLUS
	Raw stx-	ORIGINAL\PRIMARY\STEREO_MINUS
	Processed stx-	DERIVED\PRIMARY\STEREO_MINUS
2D CESM-Biopsy	Raw scout low energy	ORIGINAL\PRIMARY\STEREO_SCOUT\\LOW_ENERGY
	Processed scout low energy	DERIVED\PRIMARY\STEREO_SCOUT\\LOW_ENERGY
	Raw stx+ low energy	ORIGINAL\PRIMARY\STEREO_PLUS\\LOW_ENERGY
	Processed stx+ low energy	DERIVED\PRIMARY\STEREO_PLUS\\LOW_ENERGY
	Raw stx- low energy	ORIGINAL\PRIMARY\STEREO_MINUS\\LOW_ENERGY
	Processed stx- low energy	DERIVED\PRIMARY\STEREO_MINUS\\LOW_ENERGY
	Raw scout high energy	ORIGINAL\PRIMARY\STEREO_SCOUT\\HIGH_ENERGY
	Recombined scout	DERIVED\PRIMARY\STEREO_SCOUT\SUBTRACTION
	Raw stx+ high energy	ORIGINAL\PRIMARY\STEREO_PLUS\\HIGH_ENERGY
	Recombined stx+	DERIVED\PRIMARY\STEREO_PLUS\SUBTRACTION
	Raw stx- high energy	ORIGINAL\PRIMARY\STEREO_MINUS\\HIGH_ENERGY
	Recombined stx-	DERIVED\PRIMARY\STEREO_MINUS\SUBTRACTION
3D Routine	3D projection	ORIGINAL\PRIMARY\TOMO_PROJ\PROJECTION
	Slabs	DERIVED\PRIMARY\TOMOSYNTHESIS\MAXIMUM
	Planes	ORIGINAL\PRIMARY\TOMOSYNTHESIS\NONE
	Lossy compressed planes	DERIVED\PRIMARY\TOMOSYNTHESIS\NONE
3D Biopsy	3D projection	ORIGINAL\PRIMARY\TOMO_SCOUT
	Planes	ORIGINAL\PRIMARY\TOMO_SCOUT\NONE
	Lossy compressed planes	DERIVED\PRIMARY\TOMO_SCOUT\NONE

9.5.6.1.1 General Image Attribute Descriptions

9.5.6.1.1.1 Patient Orientation

Patient Orientation is set according to Clinical View and image pixel orientation configuration, as described in the following tables:

TABLE 87 – PATIENT ORIENTATION

Clinical View	Patient Orientation (Row orientation\Column Orientation) for images with cheswall on the left or on the right (Routine images or biopsy configured with that pixel orientation)
RCC, RXCCM, RXCCL, RXCC	P\L
CV (CC or FB views)	A\R. CV is displayed as left
LCC, LXCCM, LXCCL, LXCC	A\R
RAT, RMLO, RLMO	P\FL
LSIO, LISO	A\FL
RFB	P\L
LFB	A\R
LAT, LMLO, LLMO	A\FR
RSIO, RISO	P\FR
RML, RLM	P\F
LLM, LML	A\F

Clinical View for Biopsy procedure	Patient Orientation For Biopsy procedure (Row Orientation\Column Orientation) with chestwall at the bottom
RCC, LCC, RXCCL, LXCCL, RXCCM, LXCCM	R\P
RMLO, LSIO, RAT	HR\P
RML, LLM	H\P
LMLO, RSIO, LAT	FR\P
LML, RLM	F\P

9.5.6.1.1.2 Source Image Sequence

Only in MG for Presentation image.

Source Image Sequence references the SOP instance UID of the raw image (MG for Processing image) from which the processed image (MG for Presentation image) was created.

9-5-6-2 Image Pixel Module

TABLE 88 – IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Samples Per Pixel	(0028,0002)	1	Value is set to 1.
Photometric Interpretation	(0028,0004)	1	For Processing: MONOCHROME1. For Presentation: MONOCHROME2.
Rows	(0028,0010)	1	Value is set to the number of rows in the image pixel matrix.
Columns	(0028,0011)	1	Value is set to the number of columns in the image pixel matrix.
Bits Allocated	(0028,0100)	1	Value is set to 16.
Bits Stored	(0028,0101)	1	Value is set to: - 14 for Processing image. - 12 for Presentation image.
High Bit	(0028,0102)	1	Value is set to: - 13 for Processing image. - 11 for Presentation image.

Attribute Name	Tag	Type	Use
Pixel Representation	(0028,0103)	1	Value is set to 0000H (unsigned integer).
Pixel Data	(7FE0,0010)	1C	Value is sent and contains the actual image pixel data.
Pixel Padding Range Limit	(0028,0121)	1C	Value is sent in For Presentation SOP instances.

9-5-6-3 Display Shutter Module Attributes

TABLE 89 – DISPLAY SHUTTER MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Shutter Shape	(0018,1600)	1	Value is set to "POLYGONAL".
Vertices of the Polygonal Shutter	(0018,1620)	1C	Set to the row and column pair coordinates of the polygon shutter that defines the non-blackened area.
Shutter Presentation Value	(0018,1622)	3	Value is set to 0.

9-5-6-4 X-Ray Acquisition Dose Modules

TABLE 90 – X-RAY ACQUISITION DOSE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
KVP	(0018,0060)	3	Unit: KV (Not Present in CESM Recombined).
X-Ray Tube Current	(0018,1151)	3	Unit: mA (Not Present in CESM Recombined).
Exposure Time	(0018,1150)	3	Unit: ms (Not Present in CESM Recombined).
Exposure	(0018,1152)	3	Unit: mAs (Not Present in CESM Recombined).
Exposure in µAs	(0018,1153)	3	Unit: µAs (Not Present in CESM Recombined).
Distance Source to Detector	(0018,1110)	3	Described in DX Positioning Module.
Distance Source to Patient	(0018,1111)	3	Described in DX Positioning Module.
Body Part Thickness	(0018,11A0)	3	Unit: mm Not sent for specimen images.
Relative X-Ray Exposure	(0018,1405)	3	Skin Dose in µGy received during exposure. Not sent in CESM Recombined and specimen images.
Entrance Dose	(0040,0302)	3	Unit: dGy Not sent in CESM Recombined and specimen images.
Entrance Dose in mGy	(0040,8302)	3	Unit: mGy, decimal value Not sent in CESM Recombined and specimen images.
Distance Source to Entrance	(0040,0306)	3	Distance in mm from the source to the compression paddle. Value is set to the at 0° for all TOMO projections.
Comments on Radiation Dose	(0040,0310)	3	Breast glandularity in %. Not sent in specimen images.
Half Value Layer	(0040,0314)	3	Set to half value layer. Not sent in CESM Recombined and specimen images.
Organ Dose	(0040,0316)	3	Unit: dGy. Not sent in CESM Recombined and specimen images.
Organ Exposed	(0040,0318)	3	Value is set to BREAST. Not sent for specimen images.
Anode Target Material	(0018,1191)	3	Described in X-Ray Generation Module.
Filter Type	(0018,1160)	3	Described in X-Ray Filtration Module.
Filter Material	(0018,7050)	3	Described in X-Ray Filtration Module.

9-5-6-5 X-Ray Generation Module

TABLE 91 – X-RAY GENERATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	3	Described in X-Ray Acquisition Dose Module.
X-Ray Tube Current	(0018,1151)	3	Described in X-Ray Acquisition Dose Module.
Exposure Time	(0018,1150)	3	Described in X-Ray Acquisition Dose Module.
Exposure	(0018,1152)	3	Described in X-Ray Acquisition Dose Module.
Exposure in µAs	(0018,1153)	3	Described in X-Ray Acquisition Dose Module.
Focal Spot	(0018,1190)	3	Set to 0.1 or 0.3.
Anode Target Material	(0018,1191)	3	Set to MOLYBDENUM or RHODIUM. (Not Present in CESM Recombined).
Exposure Control Mode	(0018,7060)	3	Value is set to: “MANUAL” or “AUTOMATIC”.
Exposure Control Mode Description	(0018,7062)	3	Exposure Control Mode Description may contain the following fields: - 1st field: mode and sub mode names. - 2nd field: Pre-exposure AOP zone as: RECTANGLE COLUMN pix LINE pix WIDTH pix HEIGHT pix. - 3rd field: Exposure Detector Dose. - 4th field: Pre-exposure Detector Dose. - 5th field: Pre-exposure Radiological Thickness. - 6th field: Pre-exposure composition. - 7th field: Pre-exposure kV. - 8th field: Pre-exposure track. - 9th field: Pre-exposure filter. - 10th field: Paddle Type. - 11th field: Phantom detected (applicable for physicist tests). - 12th field sent only if the MTD is connected: Breast Support Type. - 13th field sent for DBT projections only: Conversion factor 0-degree ESE to 0-degree AGD. - 14th field sent for DBT projections only: Conversion factor pre-exposure ESE to pre-exposure AGD. - 15th field sent for DBT projections only: Pre-exposure AGD. The different values are separated by space characters. For DBT projections: - In manual mode, attribute shall contain the fields 1, 2, 3. - In AOP mode, attribute shall contain fields all fields expect 10, 12, 13 and 14. For all images except DBT projections: - In manual mode, attribute shall contain only the fields: 1, 2, 3. - In AOP mode, attribute shall contain the 11 first fields without 10th field.
Exposure Status	(0018,7064)	3	Defined Terms: NORMAL ABORTED.

9-5-6-6 X-Ray Filtration Module

TABLE 92 – X-RAY FILTRATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Filter Type	(0018,1160)	3	Set to STRIP. (Not Present in CESM Recombined).
Filter Material	(0018,7050)	3	Set to MOLYBDENUM, SILVER, or COPPER. (Not Present in CESM Recombined).

9-5-6-7 X-Ray Grid Module

TABLE 93 – X-RAY GRID MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Grid	(0018,1166)	3	Value 1: RECIPROCATING. Value 2: FOCUSED.

9-5-6-8 DX Anatomy Imaged Module

TABLE 94 – DX ANATOMY IMAGED MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Anatomic Region Sequence	(0008,2218)	2	Sent. Empty for specimen images.
>Code Value	(0008,0100)	1C	Used Code: T-04000 for Breast.
>Coding Scheme Designator	(0008,0102)	1C	The value is set to “SRT”.
>Code Meaning	(0008,0104)	1	Value is set to Breast.
Image Laterality	(0020,0062)	1	Supported Values: R = right. L = left. B = both.

9-5-6-9 DX Image Module

TABLE 95 – DX IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples Per Pixel	(0028,0002)	1	Described in Image Pixel Module.
Photometric Interpretation	(0028,0004)	1	Described in Image Pixel Module.
Bits Allocated	(0028,0100)	1	Described in Image Pixel Module.
Bits Stored	(0028,0101)	1	Described in Image Pixel Module.
High Bit	(0028,0102)	1	Described in Image Pixel Module.
Image Type	(0008,0008)	1	Described in General Image Module.
Acquisition Device Processing Description	(0018,1400)	3	Description of the processing applied to images. Only present in MG for Presentation images.
Acquisition Device Processing Code	(0018,1401)	3	Description of the processing applied to images. Only present in MG for Presentation images.
Patient Orientation	(0020, 0020)	1C	Described in General Image Module.
Pixel Representation	(0028,0103)	1	Described in Image Pixel Module.
Burned In Annotation	(0028,0301)	1	Described in General Image Module.

Attribute Name	Tag	Type	Attribute Description
Pixel Intensity Relationship	(0028,1040)	1	Value is set to: - LIN in MG for Processing image. - LOG in MG for Presentation image.
Pixel Intensity Relationship Sign	(0028,1041)	1	Value is set to: - +1 in MG for Processing image. - -1 in MG for Presentation image.
Window Center	(0028,1050)	1C	Described in VOI LUT Module.
Window Width	(0028,1051)	1C	Described in VOI LUT Module.
Rescale Intercept	(0028,1052)	1	Always set to 0.
Rescale Slope	(0028,1053)	1	Always set to 1.
Rescale Type	(0028,1054)	1	Always set to US.
Window Center and Width Explanation	(0028,1055)	3	Described in VOI LUT Module.
Presentation LUT Shape	(2050,0020)	1	Set to: - INVERSE in MG for Processing image. - IDENTITY in MG for Presentation image.
Lossy Image Compression	(0028,2110)	1	Described in General Image Module.
VOI LUT Sequence	(0028,3010)	1C	Described in VOI LUT Module.

9-5-6-10 **DX Detector Module**

TABLE 96 – DX DETECTOR MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Field of View Shape	(0018,1147)	3	Set to RECTANGLE.
Field of View Dimensions	(0018,1149)	3	Value 1 set to row dimension in mm. Value 2 set to column dimension in mm.
Sensitivity	(0018,6000)	3	Set to detector sensitivity in counts/nanoGy.
Detector Conditions Nominal Flag	(0018,7000)	3	Supported Values: - “YES” if image quality is not degraded. - “NO” if a warning message is displayed “quality image is degraded”.
Detector Temperature	(0018,7001)	3	Sent if available.
Detector Type	(0018,7004)	2	Value is set to SCINTILLATOR.
Detector Configuration	(0018,7005)	3	Value is set to AREA.
Detector Description	(0018,7006)	3	For the RAW images, the value is set to: Detector Version 3.0. For processed images, the value is set to: - Detector Version 3.0 MTFcomp 2.X, when Fineview is applied Where: "2.X " is the MTF Kernel version applied to the image, corresponding to the FineView applied. - Detector Version 3.0 NoMTFcomp, when Fineview is NOT applied Conveys the detector version and the version of the processing applied to the raw image.
Detector ID	(0018,700A)	3	The ID or serial number of the detector used to acquire this image.
Date of Last Detector Calibration	(0018,700C)	3	Date on which the last bad pixel map has been performed on the system.
Time of Last Detector Calibration	(0018,700E)	3	Time on which the last bad pixel map has been performed on the system.
Detector Element Physical Size	(0018,7020)	3	Set to 0.1\0.1.
Detector Element Spacing	(0018, 7022)	3	Row dimension and column dimension set to 0.1\0.1.

Attribute Name	Tag	Type	Attribute Description
Detector Active Shape	(0018,7024)	3	Set to RECTANGLE.
Detector Active Dimensions	(0018,7026)	3	Value 1 is set to row dimension in mm. Value 2 is set to column dimension in mm. Value = "286.0\240.0".
Field of View origin	(0018,7030)	1C	Sent if Field of View Rotation or Field of View Horizontal Flip is sent. Value for DBT Projections set to 5.0\1.0.
Field of View Rotation	(0018, 7032)	1C	Value is set to 0 ° or 180°. Sent if Field of View Horizontal Flip is sent.
Field of View Horizontal Flip	(0018, 7034)	1C	Supported Values: - YES if any flip is applied on the image. - NO. Sent if Field of View Rotation is sent.
Detector Binning	(0018,701A)	3	Set to 1.0\1.0.
Imager Pixel Spacing	(0018,1164)	1	Set to 0.1\0.1.

9-5-6-11 X-Ray Collimator Module

X-Ray Collimator module is optional and is sent only if collimation has been applied while acquiring the image.

TABLE 97 – X-RAY COLLIMATOR MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	Set to RECTANGULAR.
Collimator Left Vertical Edge	(0018,1702)	1C	Sent if Collimator shape is sent.
Collimator Right Vertical Edge	(0018,1704)	1C	Sent if Collimator shape is sent.
Collimator Upper Horizontal Edge	(0018,1706)	1C	Sent if Collimator shape is sent.
Collimator Lower Horizontal Edge	(0018,1708)	1C	Sent if Collimator shape is sent.

9-5-6-12 DX Positioning Module

TABLE 98 – DX POSITIONING MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Distance Source to Detector	(0018,1110)	3	Distance in mm from the source to the image plane.
Distance Source to Patient	(0018,1111)	3	Distance in mm from the source to the breast support. Not sent for specimen images.
Estimated Radiographic Magnification Factor	(0018,1114)	3	Set to SID/(SOD – 20 mm) for all images except breast spacer and specimen images. Set to SID/(SOD – 40mm) for images with breast spacer. Set to SID/SOD for specimen images. Where: - SID: the distance source to detector. - SOD: the distance source to patient support. **NOTES**: - This value corresponds to a position 20 mm above the breast support. - Value is greater than 1 for contact mode.
Body Part Thickness	(0018,11A0)	3	Described in X-ray Acquisition Dose. Module
Compression Force	(0018,11A2)	3	Unit: N Not sent for specimen images.

Attribute Name	Tag	Type	Attribute Description
Compression Pressure	(0018,11A3)	3	Unit: kPa Not sent for specimen images.
Compression Contact Area	(0018,11A5)	3	Unit: mm^2 Not sent for specimen images.
Positioner Type	(0018, 1508)	2	Set to MAMMOGRAPHIC.
Positioner Primary Angle	(0018,1510)	3	Position in degrees of the X-ray beam vector in the coronal anatomical plane as if the patient were standing where movement of the X-ray source from right to vertical is positive, and vertical is zero.
Detector Secondary Angle	(0018,1531)	3	Set to X-ray beam angle relative to the normal to the detector plane in degrees.
View Position	(0018,5101)	3	Equivalent to View Code Sequence Code Meaning. Set to “SAMPLE” for specimen images.
View Code Sequence	(0054,0220)	3	1 item is described in this sequence.
>Code Value	(0008,0100)	1	See list of view codes in *Table 106*.
>Code Scheme designator	(0008,0102)	1	Set to SRT in projections. Set to SNM3 otherwise.
>Code Meaning	(0008,0104)	1	See list of view code meaning in *Table 106*.
>View Modifier Code Sequence	(0054,0222)	2	Sequence is present if a modifier was selected for acquisition.
>>Code Value	(0008,0100)	1C	See list of view modifier codes in *Table 107*.
>>Code Scheme designator	(0008,0102)	1C	Set to SNM3 or SRT depending on system configuration.
>>Code Meaning	(0008,0104)	1C	See list of view modifier code meaning in *Table 107*.
Paddle Description	(0018,11A4)	3	Describes the used paddle. When no paddle is used, value is set to "PADDLE not detected". Not sent for specimen images.

9-5-6-13 **Mammography Image Module**

TABLE 99 – MAMMOGRAPHY IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Anatomic Region Sequence	(0008,2218)	1	Described in DX Anatomy Imaged Module.
>Code Value	(0008,0100)	1C	Described in DX Anatomy Imaged Module.
>Coding Scheme Designator	(0008,0102)	1C	Described in DX Anatomy Imaged Module.
>Code Meaning	(0008,0104)	1C	Described in DX Anatomy Imaged Module.
Positioner Primary Angle	(0018,1510)	3	Described in DX Positioning Module.
Positioner Primary Angle Direction	(0018,9559)	3	Value is set to “CC”: Counter Clockwise.
Positioner Type	(0018,1508)	1	Described in DX Positioning module.
Image Laterality	(0020,0062)	1	Described in DX Anatomy Imaged Module.
Implant Present	(0028,1300)	3	Indicates whether or not the patient has implants. Value set to “YES” or “NO” depending on the user entered data into the application. Not sent in specimen images.
Organ Exposed	(0040,0318)	1	Described in X-Ray Acquisition Dose Module.
View Code Sequence	(0054,0220)	1	Described in DX Positioning Module.
>Code Value	(0008,0100)	1	Described in DX Positioning Module.
>Code Scheme designator	(0008,0102)	1	Described in DX Positioning Module.
>Code Meaning	(0008,0104)	1	Described in DX Positioning Module.

Attribute Name	Tag	Type	Attribute Description
>View Modifier Code Sequence	(0054,0222)	2	Described in DX Positioning Module.
>>Code Value	(0008,0100)	1C	Described in DX Positioning Module.
>>Code Scheme designator	(0008,0102)	1C	Described in DX Positioning Module.
>>Code Meaning	(0008,0104)	1C	Described in DX Positioning Module.
Image Type	(0008,0008)	1	Described in General Image Module.
Distance Source to Detector	(0018,1110)	3	Described in DX Positioning Module.
Distance Source to Patient	(0018,1111)	3	Described in DX Positioning Module.
Biopsy Target Sequence[Biopsy Only]	(0018,2041)	3	Only present for Biopsy procedure. Only present in "FOR PRESENTATION" images. Present in the three images that have been acquired for the triplet. Not present for specimen images.
>Target UID	(0018,2042)	1	Unique identifier for the target
>Localizing Cursor Position	(0018,2043)	1	Describes the coordinates of the pixel nearest to the center of the target marker.
>Calculated Target Position	(0018,2044)	1	The calculated target position (x, y, z) in mm.
>Target Label	(0018,2045)	1	Value corresponds to the target ID displayed on the viewer.
>Displayed Z Value	(0018,2046)	1	The z value in mm displayed to user
>Private Creator	(0045,0010)	1	Value set to GEMS_SENO_02
>Biopsy device ID	(0045,10AF)	1	Value set to the needle ID used during the medical procedure when target is sent.

9-5-6-14 **Acquisition Context Module**

TABLE 100 – ACQUISITION CONTEXT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Acquisition Context Sequence	(0040,0555)	2	Zero length value is sent.

9-5-6-15 **VOI LUT Module**

TABLE 101 – VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	1C	Sent only in MG for Presentation Image. Up to 4 values are present. The 4th value is present only when the user manually changes the brightness/contrast or when the auto contrast is applied by the system.
Window Width	(0028,1051)	1C	Sent only in MG for Presentation image. Up to 4 values are present. The 4th value is present only when the user changes manually changes the brightness/contrast or when the auto contrast is applied by the system.
Window Center & Width Explanation	(0028,1055)	3	Sent only in MG for Presentation image. Up to 4 values are present (NORMAL, SOFTER, HARDER, USER).
VOI LUT Function	(0028,1056)	3	Sent only in MG for Presentation image. Possible values: - "SIGMOID" - "LINEAR"
VOI LUT Sequence	(0028,3010)	1C	Sent only in MG for Presentation image for which VOI LUT Function (0028,1056) is SIGMOID. As many items as Window Center values (0028,1050) are present in this sequence.

Attribute Name	Tag	Type	Attribute Description
>LUT Descriptor	(0028,3002)	1	Sent only in MG for Presentation image.
>LUT Explanation	(0028,3003)	3	Sent only in MG for Presentation image.
>LUT Data	(0028,3006)	1	Sent only in MG for Presentation image.

9-5-6-16 SOP Common Module

TABLE 102 – SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Set to "ISO_IR 100"
SOP Class UID	(0008,0016)	1	Value is one of: - "1.2.840.10008.5.1.4.1.1.1.2.1" for raw images. - "1.2.840.10008.5.1.4.1.1.1.2" for processed images. - "1.2.840.10008.5.1.4.1.1.13.1.3" for BTO volumes. - "1.2.840.10008.5.1.4.1.1.2" for CTO volumes. - "1.2.840.10008.5.1.4.1.1.88.67" for SR documents.
SOP Instance UID	(0008,0018)	1	UID is generated by the system.

9-5-6-17 Contrast/Bolus Module

TABLE 103 – CONTRAST BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	When injection done: contrast or bolus agent used during acquisition when data description is filled in the UI (CESM Exam). If no injection, attribute is absent.
Contrast/Bolus Volume	(0018,1041)	3	When injection done: Volume injected in milliliters of diluted contrast agent (CESM Exam). If no injection, attribute is absent.
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Milligrams of active ingredient per milliliter of (diluted) agent. Not mandatory (if not entered by user) when injection done (CESM Exam). If no injection, attribute is absent.
Contrast/Bolus Start Time	(0018,1042)	3	When injection done: Time when injection starts. (CESM Exam). If no injection, attribute is absent.

NOTE : Attributes from Table 103 are only present for CESM procedure

9-5-6-18 Application Module (Private Module)

Application Module is a private module.

The table below contains Attributes that describe various information required by the Senographe Pristina Acquisition Workstation Medical Application.

TABLE 104 – APPLICATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0045,0010)	3	Value = GEMS_SENO_02
Angulation [3D Only]	(0045,1006)	3	Equivalent of secondary angle.
Clinical View	(0045,101b)	3	Used to store Clinical View to be displayed on the image. Not sent for specimen images.

Attribute Name	Tag	Type	Attribute Description
MAO Buffer	(0045,1026)	3	Used to store annotations added by user, such as graphics or text.
Windowing parameters	(0045,1029)	3	Used to store windowing parameters.
Radiological Thickness	(0045,1049)	3	Used to store radiological thickness in mm. Not sent for specimen images.
mu	(0045,1058)	3	Sent only in MG for Presentation Image. Used to store processing Algorithm parameters.
Threshold	(0045,1059)	3	Sent only in MG for Presentation Image. Used to store processing Algorithm parameters.
Breast ROI X	(0045,1060)	3	Sent only in MG for Presentation Image. Used to store Breast ROI x coordinates. (top_left, top_right, bottom_right, bottom_left).
Breast ROI Y	(0045,1061)	3	Sent only in MG for Presentation Image. Used to store Breast ROI y coordinates (top_left, top_right, bottom_right, bottom_left).
User Window Center	(0045,1062)	3	Sent.
User Window Width	(0045,1063)	3	Sent.
Segm Threshold	(0045,1064)	3	Sent only in MG for Processing Image. Used to store processing Algorithm parameters.
Image Crop point	(0045,1072)	3	Used to store the offset in pixels of the top-left-hand-corner of the cropped image to the top-left-hand- corner of the detector area after rotating the image for display.
Premium View Beta	(0045,1090)	3	Processing Algorithm parameters.
Replacement Image	(0045,10A9)	3	Present if copy exam has been made. Value is: YES. NO.
Replaced Image Sequence	(0045,10AA)	3	Present only if Replacement image (0045,10A9) is set to YES. Contains one or more items. Contains Original instance data and purpose of reference info.
>Referenced SOP Class UID	(0008,1150)	3	SOP Class UID of original image. Possible values: Mammography SOP Class UID. For processing: 1.2.840.10008.5.1.4.1.1.1.2.1 For presentation: 1.2.840.10008.5.1.4.1.1.1.2
>Reference SOP Instance UID	(0008,1155)	3	SOP Instance UID of original image.
Purpose of Reference Code Sequence[Biopsy Only]	(0040,A170)	3	Only present for Biopsy procedure. Set to appropriate code.
>Code Value	(0008,0100)	1	Possible values: -“121312” -“121315”
>Coding Scheme Designator	(0008,0102)	1	Set to “DCM”
>Code Meaning	(0008,0104)	3	Possible values: - “Biopsy localizer” - “Other image of stereoscopic pair”

Attribute Name	Tag	Type	Attribute Description
Paddle Properties	(0045,10AD)	3	The Paddle properties attribute is a multi-valued attribute built as follow: Value1\Value2\Value3\Value4\Value5\..., Where the values are: Value 1 = paddleID (integer) Value 2 = paddle width (millimeters) Value 3 = paddle height (millimeters) Value 4 = paddle shift (text string): CENTER, LEFT, RIGHT) Value 5 = paddle ROI (pixel) Value correspond to FRONT, RIGHT, REAR, LEFT. Value 6 = Flex (boolean value: TRUE or FALSE) Value 7= Spot (boolean value: TRUE or FALSE) Value 8= paddle with hole (boolean value: TRUE or FALSE) Value 9= paddleSpecificDeflectionAccuracy (millimeters) Value 10 = is contact full field (boolean value: TRUE or FALSE) Value 11 = is mag full field (boolean value: TRUE or FALSE) Value 12 = paddle arm position (0, 1, 2, or 3) Not sent in specimen images.
Cumulative organ dose[3D Only]	(0045,10AB)	3	The cumulative organ dose delivered during preexposure (if any) and exposure of all projections of the DBT sequence up to the projection i, where i is the current projection. The value is in dGy with a precision of 0.01µGy. For 3D+2D medical procedure, pre-exposure is NOT included in (0045,10AB) as it is included in public attribute from 2D images: organ dose (0040,0316)
Cumulative entrance dose[3D Only]	(0045,10AC)	3	The cumulative entrance dose delivered during preexposure (if any) and exposure of all projections of the DBT sequence up to the projection i, where i is the current projection. The value is in dGy with a precision of 0.01µGy. For 3D+2D medical procedure, pre-exposure is NOT included in (0045,10AC) as it is included in public dicom attribute from 2D images: entrance dose in mGy (0040,8302)
Organ dose for source images[CESM ONLY]	(0045,10A1)	3	Only present in CESM Recombined images Unit: dGy List of values described as follows: "value 1 / value 2" with: value 1 = Organ dose (0040,0316) from CESM low energy value 2 = Organ dose (0040,0316) for CESM High energy Only present in CESM Recombined images. Value 1 contains pre-exposure dose.
Entrance dose in mGy for source images[CESM Only]	(0045,10A2)	3	Only present in CESM Recombined images Unit: mGy List of values described as follows: "value 1 / value 2" with: value 1 = Entrance dose in mGy (0040,8302) from CESM low energy value 2 = Entrance dose in mGy (0040,8302) for CESM High. Value 1 contains pre-exposure dose

Attribute Name	Tag	Type	Attribute Description
Biopsy Tool Sequence[Biopsy Only]	(0045,10B0)	3	The Sequence identifies the needle characteristics of a biopsy procedure. One item or more are permitted depending on the number of needle used. Present only if a biopsy procedure has been performed (target sent). Present only in processed image contained in a triplet.
>Private Creator	(0045,0010)	1	Set to “GEMS_SENO_02”
>Biopsy Device ID	(0045,10AF)	1	ID of the Biopsy Device.
>Biopsy Device Name	(0045,10B1)	1	Biopsy Device Name
>Needle Post Fire	(0045,10B2)	1	Length of the needle post fire in 1/100 mm
>Needle Notch	(0045,10B3)	1	Length of the needle notch in 1/100 mm
>Needle Tip	(0045,10B4)	1	Length of the needle tip in 1/100 mm
>Needle Diameter	(0045,10B5)	1	Needle diameter value in gauge
>Needle guide head thickness	(0045,10B6)	1	Needle guide thickness value in 1/100 mm. Used only in case of micro biopsy. Otherwise value is set to 0.
>Name of the body	(0045,10B7)	1	Describes the biopsy tool body name. Value is set to: - Revolve - ST - Magnum - Vacora - Eviva - EnCor - Generic - FNA and HOOK - Calibration Tool
>Interface type	(0045,10B8)	1	Describes interface type. Value is set to: - “H” for Horizontal - “V” for Vertical
>Body length	(0045,10B9)	1	Length of the body in 1/100 mm.
>Device Type	(0045,10BA)	1	Value is set to: - CB - VAD - CALIB - FNA - GENERIC
>Coaxial Cannula's Length	(0045,10BB)	1	Described the coaxial cannula's upper length in 1/100 mm
>Needle guide total length	(0045,10BC)	1	Full length of the needle in 1/100 mm
>Body Model Image Path	(0045,10BD)	1	Path to the body model
> Needle Axis To Body Bottom Width Distance	(0045,10BE)	1	Define the distance between the closest gun part to breast support in horizontal position and the needle. Shall be in 1/100mm Attribute is used only when Biopsy tool is "Generic"
>Needle Axis To Body Top Width Distance	(0045,10BF)	1	Define the distance between the furthest gun part to breast support in horizontal position and the needle. Shall be in 1/100mm Attribute is used only when Biopsy tool is "Generic"
>Needle Spacer length	(0045,10C0)	1	Describes the needle spacer in 1/100mm
Distance image plan to breast support[Biopsy Only]	(0045,10C1)	1	Describes the distance between the image plan to the breast support top cover in 1/100mm Not sent for specimen images.

Attribute Name	Tag	Type	Attribute Description
Breast Support Properties	(0045,10C3)	3	Describes the properties of the breast support used to acquire images.
IFF inputs	(0045,10C4)	3	IFF threshold and system AOP counts data.
Sigmoid Windowing parameters	(0045,10C7)	3	Sent only if VOI LUT Function (0028,1056) is LINEAR. Window center and window width used in the sigmoid function to transform the image to linear.

9-6 Private Data Dictionary

The table below describes the Private Attributes contained in MG images.

TABLE 105 - PRIVATE CREATOR IDENTIFICATION (GEMS_SENO_02)

Attribute Name	Tag	VR	VM
Angulation	(0045,1006)	DS	1
Clinical View	(0045,101b)	CS	1
Estimated Anat mean	(0045,1020)	DS	1
MAO Buffer	(0045,1026)	OB	1
Set Number	(0045,1027)	IS	1
Windowing parameters	(0045,1029)	DS	2
2DLocX	(0045,102a)	IS	1
2DLocY	(0045,102b)	IS	1
Radiological Thickness	(0045,1049)	DS	1
SC Instance UID	(0045,1050)	UI	1
SC series UID	(0045,1051)	UI	1
Mu	(0045,1058)	DS	1
Threshold	(0045,1059)	IS	1
Breast ROI X	(0045,1060)	IS	4
Breast ROI Y	(0045,1061)	IS	4
User Window Center	(0045,1062)	IS	1
User Window Width	(0045,1063)	IS	1
Segm Threshold	(0045,1064)	IS	1
Image Crop point	(0045,1072)	DS	2
Premium View Beta	(0045,1090)	ST	1
Signal Average Factor	(0045,10A0)	DS	1
Organ dose for source images[CESM Only]	(0045,10A1)	DS	2-n
Entrance dose in mGy for source images[CESM Only]	(0045,10A2)	DS	2-n
Replacement Image	(0045,10A9)	DS	1
Replaced Image Sequence	(0045,10AA)	SQ	1
Paddle Properties	(0045,10AD)	LO	1-n
Cumulative organ dose[3D Only]	(0045,10AB)	DS	1
Cumulative entrance dose[3D Only]	(0045,10AC)	DS	1
Biopsy Tool Sequence[Biopsy Only]	(0045,10B0)	SQ	3
>Private Creator	(0045,0010)	LO	1
>Biopsy Device ID	(0045,10AF)	SH	1
>Biopsy Device Name	(0045,10B1)	ST	1
>Needle Post Fire	(0045,10B2)	IS	1
>Needle Notch	(0045,10B3)	IS	1

Attribute Name	Tag	VR	VM
>Needle Tip	(0045,10B4)	IS	1
>Needle Diameter	(0045,10B5)	IS	1
>Needle guide head thickness	(0045,10B6)	IS	1
>Name of the body	(0045,10B7)	ST	1
>Interface type	(0045,10B8)	ST	1
>Body length	(0045,10B9)	IS	1
>Device Type	(0045,10BA)	ST	1
>Coaxial Cannula's Length	(0045,10BB)	IS	1
>Needle guide total length	(0045,10BC)	IS	1
>Body Model Image Path	(0045,10BD)	IS	1
> NeedleAxisToBodyWidthDistance	(0045,10BE)	IS	1
> NeedleAxisToBodyTopWidthDistance	(0045,10BF)	IS	1
>Needle Spacer length	(0045,10C0)	IS	1
Distance image plan to breast support[Biopsy Only]	(0045,10C1)	DS	1
Breast Support Properties	(0045,10C3)	LO	7
IFF inputs	(0045,10C4)	LO	6
Sigmoid Windowing parameters	(0045,10C7)	DS	2

9-7 Mammography View Codes

The table below lists View codes defined for mammography images.

TABLE 106 - MAMMOGRAPHY VIEW CODES

Code Value (0008,0100)	Code Meaning (0008,0104)	ACR BI-RADS Equivalent
R-10224	medio-lateral	ML
R-10226	medio-lateral oblique	MLO
R-10228	latero-medial	LM
R-10230	latero-medial oblique	LMO
R-10242	cranio-caudal	CC
R-10244	caudo-cranial (from below)	FB
R-102D0	superolateral to inferomedial oblique	SIO
R-40AAA	inferomedial to superolateral oblique	ISO
R-1024A	cranio-caudal exaggerated laterally	XCCL
R-1024B	cranio-caudal exaggerated medially	XCCM

The table below lists View Modifier codes defined for mammography images.

TABLE 107 - MAMMOGRAPHY VIEW MODIFIER CODES

Code Value (0008,0100)	Code Meaning (0008,0104)	Applies only when view is:	ACR BI-RADS Equivalent
R-102D2	Cleavage	CC or FB	CV
R-102D1	Axillary Tail	MLO	AT
R-102D3	Rolled Lateral	Any	...RL
R-102D4	Rolled Medial	Any	...RM
R-102CA	Rolled Inferior	Any	...RI
R-102C9	Rolled Superior	Any	...RS

Code Value (0008,0100)	Code Meaning (0008,0104)	Applies only when view is:	ACR BI-RADS Equivalent
R-102D5	Implant Displaced	Any	...ID
R-102D6	Magnification	Any	M...
R-102D7	Spot Compression	Any	...S
R-102C2	Tangential	Any	...TAN
R-40AB3	Nipple in profile	Any	...NP
P2-00161	Anterior compression	Any	...AC
R-40ABE	Infra-mammary fold	Any	...IMF
R-40AB2	Axillary tissue	Any	...AX

9-8 Limitations Summary

TABLE 108 – LIMITATIONS SUMMARY

Module Name	Attribute Name	Tag	Type	Attribute Description
DX Positioning	Estimated Radiographic Magnification factor	(0018,1114)	3	The Estimated Radiographic Magnification factor Set to SID/(SOD – 20 mm). Where: - SID: the distance source to detector. - SOD: the distance source to patient support. 20 mm is the estimation of the average breast thickness divided by 2. This allows having the reference plane within the breast. Value is greater than 1 for contact mode.
VOI LUT	Window Center	(0028,1050)	1C	Sent only in MG for Presentation Image. Up to 4 values are present. The 4th value is present only when the user manually changes the brightness/contrast or when the auto contrast is applied by the system. Note that proper rendering of the images requires support of (0028, 1056) VOI LUT function set to SIGMOID (see DICOM standard part 3 for further details).
VOI LUT	Window Width	(0028,1051)	1C	Sent only in MG for Presentation Image. Up to 4 values are present. The 4th value is present only when the user manually changes the brightness/contrast or when the auto contrast is applied by the system. Note that proper rendering of the images requires support of 0028, 1056 VOI LUT function set to SIGMOID (see DICOM standard part 3 for further details).

NOTE: If SOP instances which are missing the private elements defined in section Application Module (Private Module) (i.e. transferred back from a level 1 storage SCP), the review application of the Senographe Pristina might not start.

10 Breast Tomosynthesis Image Information Object Implementation

10-1 Introduction

This section specifies the use of the DICOM Breast Tomosynthesis Image IOD to represent the information included in Breast Tomosynthesis images produced by this implementation using MG images created during 3D exam with this implementation. Corresponding attributes are conveyed using the module construct.

10-2 Breast Tomosynthesis IOD Implementation

The Breast Tomosynthesis Image IOD is used for Storage Service, a SOP Class for storage of Breast Tomosynthesis images defined in PS3.4.

Breast Tomosynthesis image is reconstructed from a set of acquired source images that we call Projections. We distinguish 2 types of Breast Tomosynthesis images:

Planes: where image is defined by a series of parallel tomographic planes.

Slabs: where image is defined by a series of slabs resulting from the combination of several planes.

10-3 Breast Tomosynthesis Entity-Relationship Model

The Entity-Relationship diagram for the Breast Tomosynthesis Image interoperability schema is shown in Figure 5. In this figure, the following diagrammatic convention is established to represent the information organization:

- each entity is represented by a rectangular box.
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between 2 entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Patient for each Study. For example, a Patient can have more than one Study on the system. However, each Study will contain all of the information pertaining to that Patient.

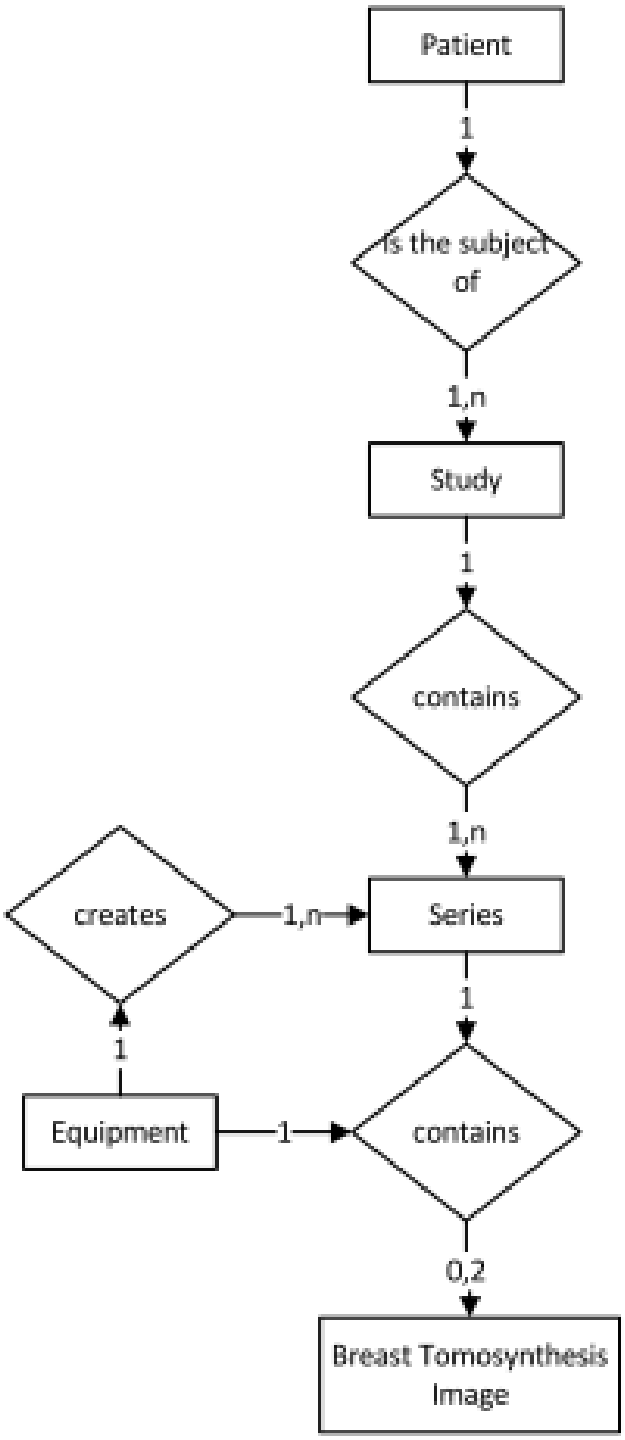


FIGURE 5 - BREAST TOMOSYNTHESIS IMAGE ENTITY RELATIONSHIP DIAGRAM.

10-3-1 Entity Descriptions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Breast Tomosynthesis Image Information Object.

10-3-2 Senographe Pristina Acquisition Workstation Mapping of DICOM entities

TABLE 109 - MAPPING OF DICOM ENTITIES TO SENOGRAPHE PRISTINA AWS ENTITIES

DICOM	Senographe Pristina Entity
Patient	Patient
Study	Study
Series	Series
Image	Image
Frame	Frame

10-4 IOD Module Table

Within an entity of the DICOM Breast Tomosynthesis Image IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 110 identifies the defined modules within the entities which comprise the DICOM Breast Tomosynthesis IOD. Modules are identified by Module Name.

See DICOM Part 3.

TABLE 110 - BREAST TOMOSYNTHESIS IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Table 77 – Patient Module Attributes
Study	General Study	Used	Table 78 – General Study Module Attributes
	Patient Study	Used	Table 79 – Patient Study Module Attributes
Series	General Series	Used	Table 80 – General Series Module Attributes
	Enhanced Mammography Series	Used	Table 112 – Enhanced Mammography Series Module Attributes
Frame of Reference	Frame of Reference	Used	Table 83 – Frame Of Reference Module Attributes
Equipment	General Equipment	Used	Table 84 – General Equipment Module Attributes
	Enhanced General Equipment	Used	Table 113 – Enhanced General Equipment Module Attributes
Image	Image Pixel	Used	Table 114 – Image Pixel Module Attributes
	Acquisition Context	Used	Table 100 – Acquisition Context Module Attributes
	Multi-frame Functional Groups	Used	Table 115 – Multi-Frame Functional Groups Module Attributes
	X-Ray 3D Image	Used	Table 116 – X-Ray 3D Image Module Attributes
	Breast Tomosynthesis Contributing Sources	Used	Table 117 – Breast Tomosynthesis Contributing Sources Module Attributes
	Breast Tomosynthesis Acquisition	Used	Table 118 – Breast Tomosynthesis Acquisition Module Attributes
	X-Ray 3D Reconstruction	Used	Table 119 – X-Ray 3D Reconstruction Module Attributes
	Breast View	Used	Table 120 – Breast View Module Attributes
	SOP Common	Used	Table 102 – SOP Common Module Attributes
Private Module	Application module	Used	Table 121 – Application Module Attributes

10-5 Breast Tomosynthesis Image Functional Group Macros

Table 111 following table specifies the use of the Functional Group macros used in the Multi-frame Functional Groups Module for the Breast Tomosynthesis Image IOD.

TABLE 111 - BREAST TOMOSYNTHESIS IMAGE FUNCTIONAL GROUP MACROS

Functional Group Macro	Usage
Pixel Measures	Used as a Shared Functional Group.
Frame Content	Used as a Per-frame Functional Group.
Plane Position (Patient)	Used as a Per-frame Functional Group.
Plane Orientation (Patient)	Used as a Shared Functional Group.
Referenced Image	Not Used.
Derivation Image	Used as a Shared Functional Group for Slabs Used as a Shared Functional Group for Planes when Lossy Compression is applied. Not used otherwise.
Frame Anatomy	Used as a Shared Functional Group.
Identity Pixel Value Transformation	Used as a Shared Functional Group.
Frame VOI LUT With LUT	Used as a Shared Functional Group.
Real Word Value Mapping	Not Used.
Contrast/Bolus Usage	Not Used.
X-Ray 3D Frame Type	Used as a Per-frame Functional Group.
Biopsy Target	Used as a Shared Functional Group.

10-6 Information Module Definitions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Breast Tomosynthesis Image Information Object.

The following modules are included to convey Supported Values and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Attributes not enclosed in the following modules are not generated by the system and are ignored when received from a remote host.

10-6-1 Common Series Entity Modules

10-6-1-1 Enhanced Mammography Series Module

TABLE 112 – ENHANCED MAMMOGRAPHY SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Described in General Series Module.
Referenced Performed Procedure Step Sequence*	(0008,1111)	1C	Described in General Series Module.
>Referenced SOP Class UID	(0008,1150)	1C	Described in General Series Module.
>Referenced SOP Instance UID	(0008,1155)	1C	Described in General Series Module.

NOTE: All items marked by an asterisk are present in the generated images only if they are referenced by an associated MPPS SOP instance.

10-6-2 Common Equipment Entity Modules

10-6-2-1 Enhanced General Equipment Module

TABLE 113 – ENHANCED GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	1	Described in General Equipment Module.
Manufacturer's Model Name	(0008,1090)	1	Described in General Equipment Module.
Device Serial Number	(0018,1000)	1	Described in General Equipment Module.
Software Versions	(0018,1020)	1	Described in General Equipment Module.

10-6-3 Common Image Entity Modules

10-6-3-1 Image Pixel Module

TABLE 114 – IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Always set to 1.
Photometric Interpretation	(0028,0004)	1	Set to MONOCHROME2.
Rows	(0028,0010)	1	Set to the number of rows.
Columns	(0028,0011)	1	Set to the number of columns.
Bits Allocated	(0028,0100)	1	Set to 16.
Bits Stored	(0028,0101)	1	Set to 12.
High Bit	(0028,0102)	1	Set to 11.
Pixel Representation	(0028,0103)	1	Always set to 0000H (unsigned integer).
Pixel Data	(7FE0,0010)	1C	Always sent.

10-6-3-2 Multi-frame Functional Groups Module

TABLE 115 – MULTI-FRAME FUNCTIONAL GROUPS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Shared Functional Groups Sequence	(5200,9229)	1	Sent with 1 item.
>Pixel Measures Sequence	(0028,9110)	1	Sent with 1 item.
>>Pixel Spacing	(0028,0030)	1C	Sent with value set to "0.1\0.1"
>>Slice Thickness	(0018,0050)	1C	Sent. Unit mm. For slabs, value set to slab thickness. For planes, value set to the distance between 2 planes.
>Plane Orientation Sequence	(0020,9116)	1	Sent with 1 item.
>>Image Orientation (Patient)	(0020,0037)	1C	Sent with 6 values. Row value for the x, y, and z axes respectively, followed by the Column value for the x, y, and z axes respectively.
>Derivation Image Sequence	(0008,9124)	2	Sent with 1 or 2 items for slabs. Sent with 1 item for planes if the image pixels have been subjected to a lossy compression. Sent with zero items otherwise.
>>Derivation Code Sequence	(0008,9215)	1	Sent with 1 or 2 items.
>>>Code Value	(0008,0100)	1	Sent with value set to "113078" or "113040".
>>>Coding Scheme Designator	(0008,0102)	1	Sent with value set to "DCM".
>>>Code Meaning	(0008,0104)	1C	Sent with value set to "Maximum intensity projection" or "Lossy Compression".

Attribute Name	Tag	Type	Attribute Description
>>Source Image Sequence	(0008,2112)	2	Sent with 1 or 2 items.
>>>Referenced SOP Class UID	(0008,1150)	1C	Sent with value set to Breast Tomosynthesis SOP Class UID: "1.2.840.10008.5.1.4.1.1.13.1.3".
>>>Referenced SOP Instance UID	(0008,1155)	1C	For Slabs, an item is sent with value set to SOP Instance UID (0008,0018) of corresponding Planes image. When lossy compression is applied, an item is sent with value set to SOP Instance UID (0008,0018) of corresponding uncompressed image.
>>>Purpose of Reference Code Sequence	(0040,A170)	1	Sent with 1 or 2 items.
>>>>Code Value	(0008,0100)	1	Sent with value set to "121322" or "121320".
>>>>Coding Scheme Designator	(0008,0102)	1	Sent with value set to "DCM".
>>>>Code Meaning	(0008,0104)	1C	Sent with value set to "Source image for image processing operation" or "Uncompressed predecessor".
>Frame Anatomy Sequence	(0020,9071)	1	Sent with 1 item.
>>Frame Laterality	(0020,9072)	1	Supported Values: R = right L = left B = both
>>Anatomic Region Sequence	(0008,2218)	1	Sent with 1 item.
>>>Code Value	(0008,0100)	1	Used Code: T-04000 for Breast
>>>Coding Scheme Designator	(0008,0102)	1C	Always set to SRT.
>>>Code Meaning	(0008,0104)	1	Set to Breast.
>Pixel Value Transformation Sequence	(0028,9145)	1	Sent with 1 item.
>>Rescale Intercept	(0028,1052)	1	Sent with value set to "0".
>>Rescale Slope	(0028,1053)	1	Sent with value set to "1".
>>Rescale Type	(0028,1054)	1	Sent with value set to "US".
>Frame VOI LUT Sequence	(0028,9132)	1	Sent with 1 item.
>>Window Center	(0028,1050)	1	Up to 3 values are present.
>>Window Width	(0028,1051)	1	Up to 3 values are present.
>>Window Center and Width Explanation	(0028,1055)	3	Sent with value set to "NORMAL" or with value set to "NORMAL\HARDER\SOFTER". (Order can be set differently).
>>VOI LUT Function	(0028,1056)	3	Possible values: - "SIGMOID" - "LINEAR"
Biopsy Target Sequence[Biopsy Only]	(0018,2041)	3	Only present for Biopsy procedure.
>Target UID	(0018,2042)	1	Unique identifier for the target
>Localizing Cursor Position	(0018,2043)	1	Describes the coordinates of the pixel nearest to the center of the target marker.
>Calculated Target Position	(0018,2044)	1	The calculated target position (x, y, z) in mm.
>Target Label	(0018,2045)	1	Value corresponds to the target ID displayed on the viewer.
>Displayed Z Value	(0018,2046)	1	The z value in mm displayed to user
>Private Creator	(0045,0010)	1	Value set to GEMS_SENO_02
>Biopsy device ID	(0045,10AF)	1	Value set to the needle ID used during the medical procedure when target is sent.
Per-frame Functional Groups Sequence	(5200,9230)	1	Sent with as many items as there are frames, starting with the frame at the detector level side.
>Frame Content Sequence	(0020,9111)	1	Sent with 1 item.
>>Frame Reference Date Time	(0018,9151)	1C	Sent with value set to date and time when 5th DBT exposure was made to acquire the image.

Attribute Name	Tag	Type	Attribute Description
>>Frame Acquisition Date Time	(0018,9074)	1C	Sent with value set to the date and time when the first exposure was made to acquire the image.
>>Frame Acquisition Duration	(0018,9220)	1C	Sent with value set to the time elapsed between first and last exposures made to acquire the image.
>Plane Position Sequence	(0020,9113)	1	Sent with 1 item.
>>Image Position (Patient)	(0020,0032)	1C	Sent with value set to "x\y\z" where x, y and z are the coordinates of the upper left hand corner of the slab/plane in mm, in Patient coordinate system.
>X-Ray 3D Frame Type Sequence	(0018,9504)	1	Sent with 1 item.
>>Frame Type	(0008,9007)	1	Sent. Value is the same as Image type (0008,0008).
>>Pixel Presentation	(0008,9205)	1	Sent with value set to "MONOCHROME".
>>Volumetric Properties	(0008,9206)	1	Sent. For slabs value is set to "SAMPLED" For planes value is set to "VOLUME".
>>Volume Based Calculation Technique	(0008,9207)	1	Sent. Value is set to “TOMOSYNTHESIS”. No difference between slabs and planes.
>>Reconstruction Index	(0020,9536)	1C	Sent. Value is set to 1.
Instance Number	(0020,0013)	1	Sent. Value is generated by the system. First image generated for the series: value is 1. One unit incrementing for each new generated image in the series.
Content Date	(0008,0023)	1	Sent with value set to the date the image is created.
Content Time	(0008,0033)	1	Sent with value set to the time the image is created.
Number of Frames	(0028,0008)	1	Sent with value set to the total number of frames in the image.

10-6-3-3 X-Ray 3D Image Module

TABLE 116 – X-RAY 3D IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Value is built as follows: Value1\Value2\Value3\Value4 Where: Value1 = “ORIGINAL” for DBT routine and biopsy Planes (except if lossy compression was applied) = “DERIVED” for DBT routine Slabs, and for DBT routine and biopsy Planes if lossy compression was applied Value2 = “PRIMARY” for DBT routine and biopsy volumes Value3 = “TOMOSYNTHESIS” for DBT routine volumes = “TOMO_SCOUT” for DBT biopsy Planes. Value4 = “MAXIMUM” for DBT routine Slabs = “NONE” for DBT routine and biopsy Planes
Pixel Presentation	(0008,9205)	1	Sent with value set to "MONOCHROME"
Volumetric Properties	(0008,9206)	1	Slabs: Set to "SAMPLED" Planes: Set to "VOLUME"

Attribute Name	Tag	Type	Attribute Description
Volume Based Calculation Technique	(0008,9207)	1	Value is set to “TOMOSYNTHESIS”. **NOTES**: they might be differences compare to instances generated by earlier product (some slabs might have SAMPLED and Planes VOLUME).
Bits Allocated	(0028,0100)	1	Described in Image Pixel Module.
Bits Stored	(0028,0101)	1	Described in Image Pixel Module.
High Bit	(0028,0102)	1	Described in Image Pixel Module.
Samples Per Pixel	(0028,0002)	1	Described in Image Pixel Module.
Photometric Interpretation	(0028,0004)	1	Described in Image Pixel Module.
Content Qualification	(0018,9004)	1	Sent with value set to "PRODUCT".
Burned In Annotation	(0028,0301)	1	Sent with value set to "NO".
Lossy Image Compression	(0028,2110)	1	Sent with values: - "00" when lossy compression NOT applied. - "01" when lossy compression applied.
Lossy Image Compression Ratio	(0028,2112)	1C	Sent only when lossy compression applied.
Lossy Image Compression Method	(0028,2114)	1C	Sent only when lossy compression applied with value set to "ISO_10918_1 (i.e. JPEG Lossy Compression).
Presentation LUT Shape	(2050,0020)	1	Sent with value set to “IDENTITY”.

10-6-3-4 **Breast Tomosynthesis Contributing Sources Module**

TABLE 117 – BREAST TOMOSYNTHESIS CONTRIBUTING SOURCES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contributing Sources Sequence	(0018,9506)	1	Sent with 1 item.
>Contributing SOP Instances Reference Sequence	(0020,9529)	1C	Sent with 1 item.
>>Study Instance UID	(0020,000D)	1	Sent with value set to attribute Study Instance UID (0020,000D) in source images.
>>Referenced Series Sequence	(0008,1115)	1	Sent with 1 item.
>>>Series Instance UID	(0020,000E)	1	Sent with value set to attribute Series Instance UID (0020,000E) in source image.
>>>Series Number	(0020,0011)	2	Sent with value set to attribute Series Number (0020,0011) in source image.
>>>Referenced Instance Sequence	(0008,114A)	1	Sent with as many items as source images.
>>>>Referenced SOP Class UID	(0008,1150)	1	Sent with value set to attribute SOP Class UID (0008,0016) of source image.
>>>>Referenced SOP Instance UID	(0008,1155)	1	Sent with value set to attribute SOP Instance UID(0008,0018) of source image.
>>>>Instance Number	(0020,0013)	2	Sent with value set to attribute Instance Number (0020,0013) of source image.
>Manufacturer	(0008,0070)	2	Sent with value set to attribute Manufacturer (0008,0070) of source image.
>Manufacturer's Model Name	(0008,1090)	1C	Sent with value set to attribute Manufacturer’s Model Name (0008,1090) in source image.
>Device Serial Number	(0018,1000)	1C	Sent with value set to attribute Device Serial Number (0018,1000) in source image. This attribute is always present in source image.
>Software Versions	(0018,1020)	1C	Sent with value set to attribute Software versions (0018,1020) in source image. This attribute is always present in source image.

Attribute Name	Tag	Type	Attribute Description
>Acquisition DateTime	(0008,002A)	1C	Sent with value set to combination of attributes Acquisition Date (0008,0022) and Acquisition Time (0008,0032) in source image. These attributes are always present in source image.
>Station Name	(0008,1010)	1C	Sent with value set to attribute Station Name (0008,1010) in source image. This attribute is always present in source image.
>Operators' Name	(0008,1070)	1C	Sent with value set to attribute Operator's name (0008,1070) in source image. This attribute is always present in source image.
>Protocol Name	(0018,1030)	1C	Sent with value set to attribute Protocol Name (0018,1030) in source image. This attribute is always present in source image.
>Acquisition Protocol Name	(0018,9423)	1C	Sent with value set to attribute Protocol Name (0018,1030) in source image. This attribute is always present in source image.
>Rows	(0028,0010)	1	Sent with value inferior or equal to attribute Rows (0028,0010) in source image.
>Columns	(0028,0011)	1	Sent with value inferior or equal to attribute Columns (0028,0011) in source image.
>Bits Stored	(0028,0101)	1	Sent with value set to attribute Bits Stored (0028,0101) in source image.
>Lossy Image Compression	(0028,2110)	1C	Sent with value set to attribute Lossy Image Compression (0028,2110) in source image. This attribute is always present in source image.
>Detector Type	(0018,7004)	1	Sent with value set to attribute Detector Type (0018,7004) in source image.
>Detector ID	(0018,700A)	1	Sent with value set to attribute Detector ID (0018,700A) in source image.
>Date of Last Detector Calibration	(0018,700C)	1	Sent with value set to attribute Date of Last Detector Calibration (0018,700C) in source image.
>Time of Last Detector Calibration	(0018,700E)	1	Sent with value set to attribute Time of Last Detector Calibration (0018,700E) in source image.
>Detector Element Spacing	(0018,7022)	1	Sent with value set to attribute Detector Element Spacing (0018,7022) in source image.

10-6-3-5 **Breast Tomosynthesis Acquisition Module**

TABLE 118 – BREAST TOMOSYNTHESIS ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
X-Ray 3D Acquisition Sequence	(0018,9507)	1	Sent with 1 item.
>Field of View Shape	(0018,1147)	1	Sent with value set to attribute Field of View Shape (0018,1147) in source image.
>X-Ray Receptor Type	(0018,9420)	1	Sent with value set to "DIGITAL_DETECTOR".
>Source Image Sequence	(0008,2112)	1C	Sent with as many items as source images.
>>Referenced SOP Class UID	(0008,1150)	1	Sent with value set to attribute SOP Class UID (0008,0016) in source image.
>>Referenced SOP Instance UID	(0008,1155)	1	Sent with value set to attribute SOP Instance UID (0008,0018) in source image.
>Field of View Dimension(s) in Float	(0018,9461)	1C	Sent with value set to attribute Field of View Dimensions (0018,1149) in source image.

Attribute Name	Tag	Type	Attribute Description
>Field of View Origin	(0018,7030)	1C	Sent with value set to attribute Field of View Origin (0018,7030) in source image.
>Field of View Rotation	(0018,7032)	1C	Sent with value set to attribute (0018,7032) in source image.
>Field of View Horizontal Flip	(0018,7034)	1C	Sent with value set to attribute Field of View Rotation (0018,7034) in source image
>Grid	(0018,1166)	1C	Sent with value set to attribute Grid (0018,1166) in source image.
>KVP	(0018,0060)	1C	Sent with value set to the average of the source images attribute KVP (0018,0060).
>X-Ray Tube Current in mA	(0018,9330)	1C	Sent with value set to the average of source images attribute X-Ray Tube Current (0018,1151).
>Exposure Time in ms	(0018,9328)	1C	Sent with value set the converted total of the source images attribute Exposure Time (0018,1150).
>Exposure in mAs	(0018,9332)	1C	Sent with value set the Converted total of the individual projections values from projections tags (0018,1153).
>Start Acquisition DateTime	(0018,9516)	1C	Sent with value set to combination of source image attributes Acquisition Date (0008,0022) and Acquisition Time (0008,0032).
>Primary Positioner Scan Arc	(0018,9508)	1C	Sent with value set to the difference between attribute Positioner Primary Angle (0018,1510) in the last and first acquired source images.
>Primary Positioner Scan Start Angle	(0018,9510)	1C	Sent with value set to the converted value from first source image attribute Positioner Primary Angle (0018,1510).
>Primary Positioner Increment	(0018,9514)	1C	Sent with value set to converted absolute value from the difference between the values from the last and first source images Positioner Primary Angle (0018,1510), divided by the number of source images.
>Distance Source to Detector	(0018,1110)	1	Distance in mm from the source to the image plane at 0°.
>Distance Source to Patient	(0018,1111)	1	Distance in mm from the source to the breast support plane at 0°.
>Estimated Radiographic Magnification Factor	(0018,1114)	1	Value is set to 1.
>Anode Target Material	(0018,1191)	1	Sent with value set to attribute Anode Target Material (0018,1191) in source image.
>Body Part Thickness	(0018,11A0)	1	Sent with value set to attribute Body Part Thickness (0018,11A0) in source image.
>Compression Force	(0018,11A2)	1	Sent with value set to attribute Compression Force (0018,11A2) in source image.
>Compression Pressure	(0018,11A3)	3	Sent with value set to attribute Compression Pressure (0018,11A3) in source image.
>Compression Contact Area	(0018,11A5)	3	Sent with value set to attribute Compression Contact Area (0018,11A5) in source image.
>Paddle Description	(0018,11A4)	1	Sent with value set to Paddle Description (0018,11A4) in source image.
>Exposure Control Mode	(0018,7060)	1	Sent with value set to attribute Exposure Control Mode (0018,7060) in source image.
>Exposure Control Mode Description	(0018,7062)	1	Sent with value set to attribute exposure Control Mode Description (0018,7062) in source image. (Not Present in CESM Recombined).
>Half Value Layer	(0040,0314)	1	Value is set to 1.

Attribute Name	Tag	Type	Attribute Description
>Focal Spot	(0018,1190)	1	Sent with value set to attribute Focal Spot (0018,1190) in source image.
>Detector Temperature	(0018,7001)	1	Sent with value set to attribute Detector Temperature (0018,7001) in source image.
>Filter Type	(0018,1160)	1	Sent with value set to attribute Filter Type (0018,1160) in source image.
>Filter Material	(0018,7050)	1	Sent with value set to attribute Filter Material (0018,7050) in source image.
>Organ Dose	(0040,0316)	3	Unit: mGy, decimal value, total organ dose of the acquisition sequence. Value comes from the tag (0045,10AB) in the last acquired projection.
>Entrance Dose in mGy	(0040,8302)	3	Unit: mGy, decimal value, total entrance dose of the acquisition sequence. Value comes from the tag (0045,10AC) in the last acquired projection.
>Per Projection Acquisition Sequence	(0018,9538)	1	Sent with as many items as source images.
>>KVP	(0018,0060)	1C	Sent with value set to attribute KVP (0018,0060) in source image.
>>X-Ray Tube Current in mA	(0018,9330)	1C	Sent with value set to conversion from attribute X-Ray Tube Current (0018,1151) in source image.
>>Collimator Shape	(0018,1700)	1C	Sent with value set to attribute Collimator Shape (0018,1700) in source image.
>>Collimator Left Vertical Edge	(0018,1702)	1C	Sent with value set to attribute Collimator Left Vertical Edge (0018,1702) in source image.
>>Collimator Right Vertical Edge	(0018,1704)	1C	Sent with value set to attribute Collimator Right Vertical Edge (0018,1704) in source image.
>>Collimator Upper Horizontal Edge	(0018,1706)	1C	Sent with value set to attribute Collimator Upper Horizontal Edge (0018,1706) in source image.
>>Collimator Lower Horizontal Edge	(0018,1708)	1C	Sent with value set to attribute Collimator Lower Horizontal Edge (0018,1708).
>>Positioner Primary Angle	(0018,1510)	1	Sent with value set to attribute Positioner Primary Angle (0018,1510) in source image.
>>Positioner Primary Angle Direction	(0018,9559)	3	Sent with "CC".
>>Exposure Time in ms	(0018,9328)	1	Sent with value set to the conversion from attribute Exposure Time (0018,1150) in source image.
>>Exposure in mAs	(0018,9332)	1	Sent with value set to the convention from attribute Exposure (0018,1152) in source image.
>>Relative X-ray Exposure	(0018,1405)	1	Sent with value set to attribute Relative X-ray Exposure (0018,1405) in source image.
>>Organ Dose	(0040,0316)	3	Sent with value set to attribute Organ Dose (0040,0316) in source image.
>>Entrance Dose in mGy	(0040,8302)	3	Sent with value set to attribute Entrance Dose in mGy (0040,8302) in source image.
>>Detector Secondary angle	(0018,1531)	E	Sent with value set to (0018,1531) in source image.
>>Detector active dimension	(0018,7026)	E	Sent with value set to (0018,7026) in source image.

NOTE: E represents Standard Extended Element.

10-6-3-6 X-Ray 3D Reconstruction Module

TABLE 119 – X-RAY 3D RECONSTRUCTION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
X-Ray 3D Reconstruction Sequence	(0018,9530)	1	Sent with one or more items.
>Application Name	(0018,9524)	1	Sent with value set to Reconstruction Package VERSION RECON_<reconstruction_box_software_version>.
>Application Version	(0018,9525)	1	Sent with value set to the reconstruction box software version.
>Application Manufacturer	(0018,9526)	1	Sent with value set to "GE HEALTHCARE".
>Algorithm Type	(0018,9527)	1	Sent with value set to "ITERATIVE".
>Acquisition Index	(0020,9518)	1	Sent with value set to "1".
>Reconstruction Description	(0018,9531)	3	Description of algorithm used for 3D reconstruction.

10-6-3-7 Breast View Module

TABLE 120 – BREAST VIEW MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image type	(0008,0008)	1	Described in X-RAY 3D IMAGE MODULE
View Code Sequence	(0054,0220)	1	Sent with 1 item.
>Code Value	(0008,0100)	1C	Sent with value copied from source image.
>Coding Scheme Designator	(0008,0102)	1C	Sent with value copied from source image.
>Code Meaning	(0008,0104)	1	Sent with value copied from source image.
>View Modifier Code Sequence	(0054,0222)	2	Sent with zero or more items.
>>Code value	(0008,0100)	1C	Sent with value copied from source image.
>>Coding Scheme Designator	(0008,0102)	1C	Sent with value copied from source image.
>>Code Meaning	(0008,0104)	1	Sent with value copied from source image.
Breast Implant Present	(0028,1300)	1C	Sent with value copied from source image.

10-6-4 Application Module (Private Module)

Application Module is a private module.

The table below contains Attributes that describe various information required by the Senographe Pristina Acquisition Workstation Medical Application.

TABLE 121 – APPLICATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0045,0010)	3	Sent with value set to "GEMS_SENO_02".
Clinical View	(0045,101b)	3	Used to store Clinical View to be displayed on the image. Not sent for specimen images.
Breast ROI X	(0045,1060)	3	Sent with value set to "top_left\top_right\bottom_right\bottom_left", where top_left, top_right, bottom_left, bottom_right are the x coordinates of the Breast ROI [pixels].
Breast ROI Y	(0045,1061)	3	Sent with value set to "top_left\top_right\bottom_right\bottom_left", where top_left, top_right, bottom_left, bottom_right are the y coordinates of the Breast ROI [pixels].

Attribute Name	Tag	Type	Attribute Description
Radiological Thickness	(0045,1049)	3	Sent with value copied from source image.
SOP Instance UID for the lossy compression	(0045,10A6)	3	Sent with value set to the potential related SOP Instance that has lossy compression applied.
Reconstruction parameters	(0045,10A7)	3	Contains the following fields: 1st field: Distance in mm between consecutive tomographic planes [ex: Z_SAMPLING_MM 0.5] 2nd field: Boolean value, indicating if the calcification artifact management is applied or not [ex: ARTIFACT_MGT true] 3rd field: Distance in mm between image receptor and MTD [ex: IR2MTD_MM 25] 4th field: Extra offset in mm to be added to IR2MTD_MM to obtain the z position of the first tomographic plane in the volume of interest [ex: IR2MTD_OFFSET_MM 5] 5th field: Extra thickness in mm to be added to the thickness reported in the DICOM header when defining the volume of interest [ex: EXTRA_THICKNESS_MM 5] 6th field: Boolean value, indicating if FineView is applied or not [ex: FINE_VIEW true] 7th field for DBT Slabs only: Slab computation method; the valid values are "no_slabs", "conic_slabs", "improved_slabs" and "parallel_slabs" [ex: SLAB_COMPUTATION_METHOD improved_slabs] 8th field: Fine View force , The value comes from the recon box config file. [ex: FINE_VIEW_FORCE 3.00]
Biopsy Tool Sequence[Biopsy Only]	(0045,10B0)	3	The Sequence identifies the needle characteristics of a biopsy procedure. One item or more are permitted depending on the number of needle used. Present only if a biopsy procedure has been performed (target sent).
>Private Creator	(0045,0010)	1	Set to “GEMS_SENO_02”
>Biopsy Device ID	(0045,10AF)	1	ID of the Biopsy Device.
>Biopsy Device Name	(0045,10B1)	1	Biopsy Device Name
>Needle Post Fire	(0045,10B2)	1	Length of the needle post fire in 1/100 mm
>Needle Notch	(0045,10B3)	1	Length of the needle notch in 1/100 mm
>Needle Tip	(0045,10B4)	1	Length of the needle tip in 1/100 mm
>Needle Diameter	(0045,10B5)	1	Needle diameter value in gauge
>Needle guide head thickness	(0045,10B6)	1	Needle guide thickness value in 1/100 mm. Used only in case of micro biopsy. Otherwise value is set to 0.
>Name of the body	(0045,10B7)	1	Describes the biopsy tool body name. Value is set to: - Revolve - ST - Magnum - Vacora - Eviva - EnCor - Generic - FNA and HOOK - Calibration Tool
>Interface type	(0045,10B8)	1	Describes interface type. Value is set to: - “H” for Horizontal - “V” for Vertical
>Body length	(0045,10B9)	1	Length of the body in 1/100 mm.

Attribute Name	Tag	Type	Attribute Description
>Device Type	(0045,10BA)	1	Value is set to: - CB - VAD - CALIB - FNA - GENERIC
>Coaxial Cannula's Length	(0045,10BB)	1	Described the coaxial cannula's upper length in 1/100 mm
>Needle guide total length	(0045,10BC)	1	Full length of the needle in 1/100 mm
>Body Model Image Path	(0045,10BD)	1	Path to the body model
> Needle Axis To Body Bottom Width Distance	(0045,10BE)	1	Define the distance between the closest gun part to breast suport in horizontal position and the needle. Shall be in 1/100mm Attribute is used only when Biopsy tool is "Generic"
>Needle Axis To Body Top Width Distance	(0045,10BF)	1	Define the distance between the furthest gun part to breast suport in horizontal position and the needle. Shall be in 1/100mm Attribute is used only when Biopsy tool is "Generic"
>Needle Spacer length	(0045,10C0)	1	Describes the needle spacer in 1/100mm
CTO reserved series instance UID	(0045,10C5)	3	Sent with value set to potential series UID of the volume when exported as CTO.
CTO reserved SOP instance UIDs sequence	(0045,10C6)	3	Sent with a sequence of potential SOP instance UIDs of each frame when the volume is exported as CTO.
>Referenced SOP Instance UID	(0008,1155)	3	SOP Instance UID of each frame when volume is exported as CTO.
Sigmoid Windowing parameters	(0045,10C7)	3	Sent only if VOI LUT Function (0028,1056) is LINEAR. Window center and window width used in the sigmoid function to transform the image to linear.

10-7 Private Data Dictionary

The table below describes the Private Attributes contained in Breast Tomosynthesis images:

TABLE 122 - PRIVATE CREATOR IDENTIFICATION (GEMS_SENO_02)

Attribute Name	Tag	VR	VM
Clinical View	(0045,101b)	CS	1
Radiological Thickness	(0045,yy49)	DS	1
Breast ROI X	(0045,yy60)	IS	4
Breast ROI Y	(0045,yy61)	IS	4
SOP Instance UID for the lossy compression	(0045,yyA6)	UI	1
Reconstruction parameters	(0045,yyA7)	LT	1
CTO reserved series instance UID	(0045,yyC5)	UI	1
CTO reserved SOP instance UIDs sequence	(0045,yyC6)	SQ	1
Sigmoid Windowing parameters	(0045,yyC7)	DS	2

10-8 Limitations summary

There are no known limitations for Breast Tomosynthesis Image IOD Implementation.

11 Computed Tomography Image Information Object Implementation

11-1 Introduction

This section specifies the use of the DICOM Computed Tomography Image IOD to represent the information included in CT images produced by this implementation. Corresponding attributes are conveyed using the module construct.

11-2 Computed Tomography IOD Implementation

The Computed Tomography Image IOD is used for Storage Service, a SOP Class for storage of CT images defined in PS3.4.

CT images are reconstructed from a set of acquired source images that we call Projections. We distinguish 2 types of CT images:

Planes: where images are defined by a series of parallel tomographic planes.

Slabs: where images are defined by a series of slabs resulting from the combination of several planes.

11-3 Computed Tomography Entity-Relationship Model

The Entity-Relationship diagram for the Computed Tomography Image interoperability schema is shown in Figure 5. In this figure, the following diagrammatic convention is established to represent the information organization:

- each entity is represented by a rectangular box.
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between 2 entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Patient for each Study. For example, a Patient can have more than one Study on the system. However, each Study will contain all of the information pertaining to that Patient.

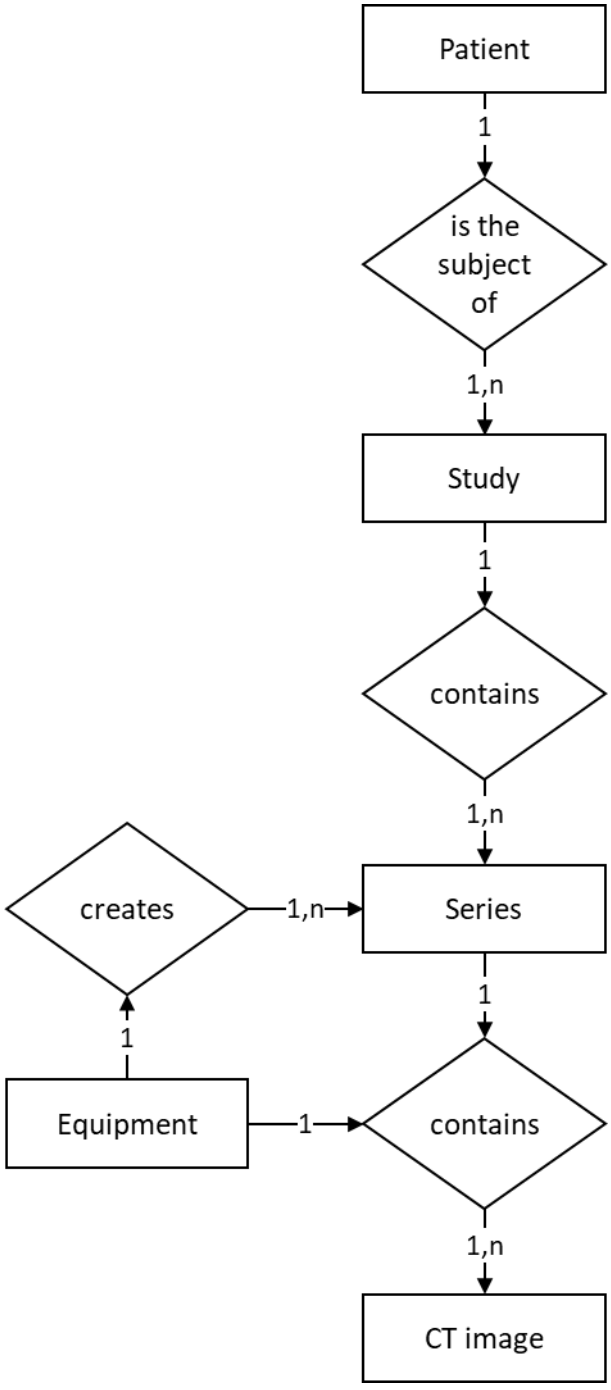


FIGURE 6 – CT IMAGE ENTITY RELATIONSHIP DIAGRAM.

11-3-1 Entity Descriptions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Computed Tomography Image Information Object.

11-3-2 Senographe Pristina Acquisition Workstation Mapping of DICOM entities

TABLE 123 - MAPPING OF DICOM ENTITIES TO SENOGRAPHE PRISTINA AWS ENTITIES

DICOM	Senographe Pristina Entity
Patient	Patient
Study	Study

DICOM	Senographe Pristina Entity
Series	Series
Image	Image
Frame	Frame

11-4 IOD Module Table

Within an entity of the DICOM Computed Tomography Image IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 124 identifies the defined modules within the entities which comprise the DICOM Computed Tomography IOD. Modules are identified by Module Name.

See DICOM Part 3.

TABLE 124 - BREAST TOMOSYNTHESIS IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Table 77 – Patient Module Attributes
Study	General Study	Used	Table 78 – General Study Module Attributes
	Patient Study	Used	Table 79 – Patient Study Module Attributes
Series	General Series	Used	Table 80 – General Series Module Attributes
Frame of Reference	Frame of Reference	Used	Table 83 – Frame Of Reference Module Attributes
Equipment	General Equipment	Used	Table 84 – General Equipment Module Attributes
Image	General Image	Used	Table 125 – General Image Module Attributes
	General Reference	Used	Table 126 – General Reference Module Attributes
	Image Plane	Used	Table 127 – Image Plane Module Attributes
	Image Pixel	Used	Table 128 – Image Pixel Module Attributes
	CT Image	Used	Table 129 – CT Image Module Attributes
	VOI LUT	Used	Table 130 – VOI LUT Module Attributes
	SOP Common	Used	Table 102 – SOP Common Module Attributes
Standard Extended	Standard Extended	Used	Table 131 – Standard Extended Attributes
Private Module	Application module	Used	Table 132 – Application Module Attributes

11-5 Information Module Definitions

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Computed Tomography Image Information Object.

The following modules are included to convey Supported Values and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Attributes not enclosed in the following modules are not generated by the system and are ignored when received from a remote host.

11-5-1 Common Image Entity Modules

11-5-1-1 General Image Module

TABLE 125 – GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Value is generated by the system. One number per image, starting at 0.
Content Date	(0008,0023)	2C	Sent with value set to the date the image is created.
Content Time	(0008,0033)	2C	Sent with value set to the time the image is created.
Image Type	(0008,0008)	3	Set to: - "DERIVED\PRIMARY\TOMO\PLANES" for planes - "DERIVED\PRIMARY\TOMO\SLABS" for slabs
Acquisition Number	(0020,0012)	3	Set to frame number, starting at 0
Acquisition Date	(0008,0022)	3	Sent with value of Acquisition Date (0008,0022) in source image
Acquisition Time	(0008,0032)	3	Sent with value of Acquisition Time (0008,0032) in source image
Acquisition DateTime	(0008,002A)	3	Combination of attributes Acquisition Date (0008,0022) and Acquisition Time (0008,0032)
Images in Acquisition	(0020,1002)	3	Sent with value set to the total number of frames in the series.
Burned In Annotation	(0028,0301)	3	Sent with value set to "NO".
Lossy Image Compression	(0028,2110)	3	Sent with value set to "00".
Presentation LUT Shape	(2050,0020)	3	Sent with value set to “IDENTITY”.
Image Laterality	(0020,0062)	3	Supported Values: R = right L = left B = both
Anatomic Region Sequence	(0008,2218)	3	Sent with 1 item.
>Code Value	(0008,0100)	1C	Used Code: T-04000 for Breast
>Coding Scheme Designator	(0008,0102)	1C	Always set to SRT.
>Code Meaning	(0008,0104)	1C	Set to Breast.

11-5-1-2 General Reference Module

TABLE 126 – GENERAL REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Source Image Sequence	(0008,2112)	1	Sent with as many items as source images.
>Referenced SOP Class UID	(0008,1150)	1	Sent with value set to attribute SOP Class UID (0008,0016) in source image.
>Referenced SOP Instance UID	(0008,1155)	1	Sent with value set to attribute SOP Instance UID (0008,0018) in source image.

11-5-1-3 Image Plane Module

TABLE 127 – IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Sent with value set to "0.1\0.1"

Attribute Name	Tag	Type	Attribute Description
Image Orientation (Patient)	(0020,0037)	1	Sent with 6 values. Row value for the x, y, and z axes respectively, followed by the Column value for the x, y, and z axes respectively.
Image Position (Patient)	(0020,0032)	1	Sent with value set to "x\y\z" where x, y and z are the coordinates of the upper left hand corner of the slab/plane in mm, in Patient coordinate system.
Slice Thickness	(0018,0050)	2	Sent. Unit mm. For slabs, value set to slab thickness. For planes, value set to the distance between 2 planes.
Slice Location	(0020,1041)	3	Set to Instance Number x Slice thickness

11-5-1-4 **Image Pixel Module**

TABLE 128 – IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Always set to 1.
Photometric Interpretation	(0028,0004)	1	Set to MONOCHROME2.
Rows	(0028,0010)	1	Set to the number of rows.
Columns	(0028,0011)	1	Set to the number of columns.
Bits Allocated	(0028,0100)	1	Set to 16.
Bits Stored	(0028,0101)	1	Set to 12.
High Bit	(0028,0102)	1	Set to 11.
Pixel Representation	(0028,0103)	1	Always set to 0000H (unsigned integer).
Pixel Data	(7FE0,0010)	1C	Always sent.

11-5-1-5 **CT Image Module**

TABLE 129 – CT IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Already defined in General Image Module
Samples per Pixel	(0028,0002)	1	Already defined in Image Pixel module
Photometric Interpretation	(0028,0004)	1	Already defined in Image Pixel module
Bits Allocated	(0028,0100)	1	Already defined in Image Pixel module
Bits Stored	(0028,0101)	1	Already defined in Image Pixel module
High Bit	(0028,0102)	1	Already defined in Image Pixel module
Rescale Intercept	(0028,1052)	1	Sent with value set to "0".
Rescale Slope	(0028,1053)	1	Sent with value set to "1".
Rescale Type	(0028,1054)	1C	Sent with value set to "US".
KVP	(0018,0060)	2	Sent with value set to the average of the source images attribute KVP (0018,0060).
Acquisition Number	(0020,0012)	2	Already defined in General Image Module
Distance source to detector	(0018,1110)	3	Distance in mm from the source to the image plane at 0°.
Distance source to patient	(0018,1111)	3	Distance in mm from the source to the breast support plane at 0°.
Exposure Time	(0018,1150)	3	Sent with value set the converted total of the source images attribute Exposure Time (0018,1150).

Attribute Name	Tag	Type	Attribute Description
X-Ray Tube Current	(0018,1151)	3	Sent with value set to the average of source images attribute X-Ray Tube Current (0018,1151).
Exposure	(0018,1152)	3	Sent with value set the total of the individual projections values from projections tags (0018,1152).
Exposure in µAs	(0018,1153)	3	Sent with value set the total of the individual projections values from projections tags (0018,1153).
Filter Type	(0018,1160)	3	Sent with value set to attribute Filter Type (0018,1160) in source image.
Focal Spot(s)	(0018,1190)	3	Sent with value set to attribute Focal Spot (0018,1190) in source image.
Anatomic Region Sequence	(0008,2218)	3	Already defined in General Image Module
>Code Value	(0008,0100)	1C	Already defined in General Image Module
>Coding Scheme Designator	(0008,0102)	1C	Already defined in General Image Module
>Code Meaning	(0008,0104)	1C	Already defined in General Image Module
View Code Sequence	(0054,0220)	3	Sent with 1 item.
>Code Value	(0008,0100)	1C	Sent with value copied from source image.
>Coding Scheme Designator	(0008,0102)	1C	Sent with value copied from source image.
>Code Meaning	(0008,0104)	1C	Sent with value copied from source image.
>View Modifier Code Sequence	(0054,0222)	3	Sent with zero or more items.
>>Code value	(0008,0100)	1C	Sent with value copied from source image.
>>Coding Scheme Designator	(0008,0102)	1C	Sent with value copied from source image.
>>Code Meaning	(0008,0104)	1C	Sent with value copied from source image.

11-5-1-6 VOI LUT Module

TABLE 130 – VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	1	Up to 3 values are present.
Window Width	(0028,1051)	1	Up to 3 values are present.
Window Center and Width Explanation	(0028,1055)	3	Up to 3 values are present ("NORMAL", "HARDER", "SOFTER").
VOI LUT Function	(0028,1056)	3	Possible values: - "SIGMOID" - "LINEAR"

11-5-2 Standard Extended attributes

The Computed Tomography SOP class is standard extended by the attributes in this section.

TABLE 131 – STANDARD EXTENDED ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Field of View Shape	(0018,1147)	3	Sent with value set to attribute Field of View Shape (0018,1147) in source image.
Field of View Dimension(s) in Float	(0018,9461)	3	Sent with value set to attribute Field of View Dimensions (0018,1149) in source image.
Field of View Origin	(0018,7030)	3	Sent with value set to attribute Field of View Origin (0018,7030) in source image.

Attribute Name	Tag	Type	Attribute Description
Field of View Rotation	(0018,7032)	3	Sent with value set to attribute (0018,7032) in source image.
Field of View Horizontal Flip	(0018,7034)	3	Sent with value set to attribute Field of View Rotation (0018,7034) in source image
Grid	(0018,1166)	3	Sent with value set to attribute Grid (0018,1166) in source image.
Anode Target Material	(0018,1191)	3	Sent with value set to attribute Anode Target Material (0018,1191) in source image.
Body Part Thickness	(0018,11A0)	3	Sent with value set to attribute Body Part Thickness (0018,11A0) in source image.
Compression Force	(0018,11A2)	3	Sent with value set to attribute Compression Force (0018,11A2) in source image.
Paddle Description	(0018,11A4)	3	Sent with value set to Paddle Description (0018,11A4) in source image.
Exposure Control Mode	(0018,7060)	3	Sent with value set to attribute Exposure Control Mode (0018,7060) in source image.
Exposure Control Mode Description	(0018,7062)	3	Sent with value set to attribute exposure Control Mode Description (0018,7062) in source image.
Half Value Layer	(0040,0314)	3	Value is set to 1.
Detector Temperature	(0018,7001)	3	Sent with value set to attribute Detector Temperature (0018,7001) in source image.
Positioner Primary Angle	(0018,1510)	3	Sent with value set to attribute Positioner Primary Angle (0018,1510) in source image.
Detector ID	(0018,700A)	3	Sent with value set to attribute Detector ID (0018,700A) in source image.
Filter Material	(0018,7050)	3	Sent with value set to attribute Filter Material (0018,7050) in source image.
Organ Dose	(0040,0316)	3	Sent with value set to attribute Organ Dose (0040,0316) in source image.
Entrance Dose in mGy	(0040,8302)	3	Sent with value set to attribute Entrance Dose in mGy (0040,8302) in source image.
Acquisition Device Processing Code	(0018,1401)	3	Description of algorithm used for reconstruction.

11-5-3 Application Module (Private Module)

Application Module is a private module.

The table below contains Attributes that describe various information required by the Senographe Pristina Acquisition Workstation Medical Application.

TABLE 132 – APPLICATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0045,0010)	3	Sent with value set to "GEMS_SENO_02".
Breast ROI X	(0045,1060)	3	Sent with value set to "top_left\top_right\bottom_right\bottom_left", where top_left, top_right, bottom_left, bottom_right are the x coordinates of the Breast ROI [pixels].
Breast ROI Y	(0045,1061)	3	Sent with value set to "top_left\top_right\bottom_right\bottom_left", where top_left, top_right, bottom_left, bottom_right are the y coordinates of the Breast ROI [pixels].

Attribute Name	Tag	Type	Attribute Description
Radiological Thickness	(0045,1049)	3	Sent with value copied from source image.
Reconstruction parameters	(0045,10A7)	3	Contains the following fields: 1st field: Distance in mm between consecutive tomographic planes [ex: Z_SAMPLING_MM 0.5] 2nd field: Boolean value, indicating if the calcification artifact management is applied or not [ex: ARTIFACT_MGT true] 3rd field: Distance in mm between image receptor and MTD [ex: IR2MTD_MM 25] 4th field: Extra offset in mm to be added to IR2MTD_MM to obtain the z position of the first tomographic plane in the volume of interest [ex: IR2MTD_OFFSET_MM 5] 5th field: Extra thickness in mm to be added to the thickness reported in the DICOM header when defining the volume of interest [ex: EXTRA_THICKNESS_MM 5] 6th field: Boolean value, indicating if FineView is applied or not [ex: FINE_VIEW true] 7th field for DBT Slabs only: Slab computation method; the valid values are "no_slabs", "conic_slabs", "improved_slabs" and "parallel_slabs" [ex: SLAB_COMPUTATION_METHOD improved_slabs] 8th field: Fine View force , The value comes from the recon box config file. [ex: FINE_VIEW_FORCE 3.00]
Sigmoid Windowing parameters	(0045,10C7)	3	Sent only if VOI LUT Function (0028,1056) is LINEAR. Window center and window width used in the sigmoid function to transform the image to linear.

11-6 Private Data Dictionary

The table below describes the Private Attributes contained in Breast Tomosynthesis images.

TABLE 133 - PRIVATE CREATOR IDENTIFICATION (GEMS_SENO_02)

Attribute Name	Tag	VR	VM
Radiological Thickness	(0045,yy49)	DS	1
Breast ROI X	(0045,yy60)	IS	4
Breast ROI Y	(0045,yy61)	IS	4
SOP Instance UID for the lossy compression	(0045,yyA6)	UI	1
Reconstruction parameters	(0045,yyA7)	LT	1
Sigmoid windowing parameters	(0045,yyC7)	DS	2

11-7 Limitations summary

There are no known limitations for Computed Tomography Image IOD Implementation.

12 X-Ray Radiation Dose Structured Report Information Object Implementation

12-1 Introduction

This section specifies the use of the DICOM X-Ray Radiation Dose SR IOD to represent results produced by Senographe Pristina.

12-2 IOD Module Table

The X-Ray Radiation Dose Structured Report Information Object Definition comprise the modules of the following tables.

The contents of the SR Document are constrained by the supported template.

TABLE 134 - STRUCTURED REPORT IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Table 77 – Patient Module Attributes
Study	General Study	Used	Table 78 – General Study Module Attributes
	Patient Study	Used	Table 79 – Patient Study Module Attributes
Series	SR Document Series	Used	Table 135 – SR Document Series Module Attributes
Equipment	General Equipment	Used	Table 84 – General Equipment Module Attributes
	Enhanced General Equipment	Used	Table 136 – Enhanced General Equipment Module Attributes
Document	SR Document General	Used	Table 137 – SR Document General Module Attributes
	SR Document Content	Used	Table 138 – SR Document content module attributes
	SOP Common	Used	Table 102 – SOP Common Module Attributes

12-3 Information Module Definitions

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the SR Information Objects.

12-3-1 Series Entity Modules

12-3-1-1 SR Document Series Module

TABLE 135 – SR DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Value = “SR”
Series Instance UID	(0020,000E)	1	Unique identifier of the SR Series
Series Number	(0020,0011)	1	Number generated by the system. Starts at 900.
Series Date	(0008,0021)	3	Date the Series started
Series Time	(0008,0031)	3	Time the Series started
Series Description	(0008,103E)	3	Value = "Radiation Dose Structured Report"
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Identifies the Performed Procedure Step SOP Instance in which the Series is created. Identical to the MPPS of the image Series.
>Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.
>Referenced SOP instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.

12-3-2 Equipment Entity Modules

12-3-2-1 Enhanced General Equipment Module

TABLE 136 – ENHANCED GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	1	Already defined in Table 84 – General Equipment Module Attributes
Manufacturer's Model Name	(0008,1090)	1	Already defined in Table 84 – General Equipment Module Attributes
Device Serial Number	(0018,1000)	1	Already defined in Table 84 – General Equipment Module Attributes
Software Versions	(0018,1020)	1	Already defined in Table 84 – General Equipment Module Attributes

12-3-3 Document Entity Modules

12-3-3-1 SR Document General Module

TABLE 137 – SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	Value = “1”
Preliminary Flag	(0040,A496)	3	Value = “FINAL“
Completion Flag	(0040,A491)	1	Value = “COMPLETE”
Verification Flag	(0040,A493)	1	Value = “UNVERIFIED”
Content Date	(0008,0023)	1	Value set to the date the document is created.
Content Time	(0008,0033)	1	Value set to the time the document is created.
Referenced Request Sequence	(0040,A370)	1C	Identifies Requested Procedure that is fulfilled by creation of this Document when SPS retrieved from HIS/RIS. Not sent otherwise.
>Study Instance UID	(0020,000D)	1	Study Instance UID copied from SPS
>Referenced Study Sequence	(0008,1110)	2	Value copied from SPS if present in SPS, empty otherwise.
>>Referenced SOP Class UID	(0008,1150)	1	Value copied from SPS
>>Referenced SOP Instance UID	(0008,1155)	1	Value copied from SPS
>Accession Number	(0008,0050)	2	Value copied from SPS if present in SPS, empty otherwise.
>Placer Order Number	(0040,2016)	2	Empty
>Filler Order Number	(0040,2017)	2	Empty
>Requested Procedure ID	(0040,1001)	2	Value copied from SPS if present in SPS, empty otherwise.
>Requested Procedure Description	(0032,1060)	2	Value copied from SPS if present in SPS, empty otherwise.
>Requested Procedure Code Sequence	(0032,1064)	2	Value copied from SPS if present in SPS, empty otherwise.
>Code Value	(0008,0100)	1	Sent if a sequence item is present
>Code scheme designator	(0008,0102)	1	Sent if a sequence item is present
>Code meaning	(0008,0104)	1	Sent if a sequence item is present
Performed Procedure Code Sequence	(0040,A372)	2	Conveys the type of procedure performed.
>Code Value	(0008,0100)	1	Sent if a sequence item is present
>Code scheme designator	(0008,0102)	1	Sent if a sequence item is present
>Code meaning	(0008,0104)	1	Sent if a sequence item is present

Attribute Name	Tag	Type	Attribute Description
Current Requested Procedure Evidence Sequence	(0040,A375)	1C	Provides references to the list of all the acquired and stored x-ray images of the study.
>Study Instance UID	(0020,000D)	1	Sent if a sequence item is present
>Referenced Series Sequence	(0008,1115)	1	Sent if a sequence item is present
>>Series Instance UID	(0020,000E)	1	Sent if a sequence item is present
>>Referenced SOP Sequence	(0008,1199)	1	Sent if a sequence item is present
>>>Referenced SOP Class UID	(0008,1150)	1	Sent if a sequence item is present
>>>Referenced SOP Instance UID	(0008,1155)	1	Sent if a sequence item is present

12-3-3-2 SR Document Content Module

TABLE 138 – SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Value Type	(0040,A040)	1	Value = ”CONTAINER”
Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	Value = “113701”
>code scheme designator	(0008,0102)	1	Value = “DCM”
>Code meaning	(0008,0104)	1	Value = “X-Ray Radiation Dose Report”
Continuity of Content	(0040,A050)	1C	Value = "SEPARATE"
Content Template Sequence	(0040,A504)	1C	
>Mapping Resource	(0008,0105)	1	Value = “DCMR”
>Template Identifier	(0040,DB00)	1	Vaue = “10001”
Content Sequence	(0040,A730)	1C	See Table 139 – TID 10001 – Projection X-Ray Radiation Dose

TABLE 139 – TID 10001 – PROJECTION X-RAY RADIATION DOSE

NL	Rel with parent	VT	Concept name	Value	TID
		CONTAINER	(113701, DCM, "X-Ray Radiation Dose Report")	Root node	10001
>	HAS CONCEPT MOD	CODE	(121058, DCM, "Procedure reported")	(P5-40010, SRT, "Mammography")	10001
>>	HAS CONCEPT MOD	CODE	(G-C0E8, SRT, "Has Intent")	(R-408C3, SRT, “Diagnostic Intent”)	10001
>	HAS OBS CONTEXT	CODE	(121005, DCM, "Observer Type")	(121007, DCM, "Device")	1002
>	HAS OBS CONTEXT	UIDREF	(121012, DCM, "Device Observer UID")	Unique identifier for the equipment	1004
>	HAS OBS CONTEXT	TEXT	(121013, DCM, "Device Observer Name")	Set to workstation hostname. Same value as Station Name (0008,1010)	1004
>	HAS OBS CONTEXT	TEXT	(121014, DCM, "Device Observer Manufacturer")	"GE HEALTHCARE"	1004
>	HAS OBS CONTEXT	TEXT	(121015, DCM, "Device Observer Model Name")	“Senographe Pristina”	1004
>	HAS OBS CONTEXT	TEXT	(121016, DCM, "Device Observer Serial Number")	Set to device serial number. Same value as Device Serial Number (0008,1000)	1004
>	HAS OBS CONTEXT	CODE	(113876, DCM, "Device Role in Procedure")	(113859, DCM, “Irradiating Device”)	1004

NL	Rel with parent	VT	Concept name	Value	TID
>	HAS OBS CONTEXT	TEXT	(110119, DCM, "Station AE Title")	AE Title of the acquisition device.	1004
>	HAS OBS CONTEXT	CODE	(113705, DCM, "Scope of Accumulation")	(113014, DCM, “Study”)	10001
>>	HAS PROPERTIES	UIDREF	(110180, DCM, “Study Instance UID”)	Study Instance UID. Same value as Study Instance UID (00020,000D)	10001
>	CONTAINS	CODE	(113945, DCM, "X-Ray Detector Data Available")	(R-0038D, SRT, “Yes”)	10001
>	CONTAINS	CODE	(113943, DCM, "X-Ray Source Data Available")	(R-0038D, SRT, “Yes”)	10001
>	CONTAINS	CODE	(113944, DCM, "X-Ray Mechanical Data Available")	(R-0038D, SRT, “Yes”)	10001
>	CONTAINS	CONTAINER	(113702, DCM, "Accumulated X-Ray Dose Data")		10002
>>	HAS CONCEPT MOD	CODE	(113764, DCM, "Acquisition Plane")	(113622, DCM, "Single Plane")	10002
>>	CONTAINS	NUM	(111637, DCM, “Accumulated Average Glandular Dose")	Units = (mGy, UCUM, "mGy") Value = left breast dose	10005
>>>	HAS CONCEPT MOD	CODE	(272741003, SCT, "Laterality")	(T-04030, SRT, ”Left Breast”)	10005
>>	CONTAINS	NUM	(111637, DCM, “Accumulated Average Glandular Dose")	Units = (mGy, UCUM, "mGy") Value = right breast dose	10005
>>>	HAS CONCEPT MOD	CODE	(272741003, SCT, "Laterality")	(T-04020, SRT, ”Right Breast”)	10005
>	CONTAINS	CONTAINER	(113706, DCM, "Irradiation Event X-Ray Data")	Container repeated for each irradiation event.	10003
>>	HAS CONCEPT MOD	CODE	(113764, DCM, "Acquisition Plane")	(113622, DCM, “Single Plane”)	10003
>>	CONTAINS	UIDREF	(113769, DCM, "Irradiation Event UID")	Unique identifier for the irradiation event	10003
>>	CONTAINS	DATETIME	(111526, DCM, "DateTime Started")	Date and time of the irradiation event	10003
>>	CONTAINS	CODE	(113721, DCM, "Irradiation Event Type")	For 2D: (113611, DCM, “Stationary Acquisition”) For 3D: (113613, DCM, “Rotational Acquisition”)	10003
>>	CONTAINS	TEXT	(125203, DCM, "Acquisition Protocol")	"ROUTINE" or "3D_ROUTINE" or “CESM” or “3D_ROUTINE+2D_ROUTINE” or “STEREO” or “3D_BIOPSY” or “SAMPLE” or “CESM_BIOPSY”	10003
>>	CONTAINS	CODE	(T-D0005, SRT, "Anatomical structure")	(T-04000, SRT, “Breast”)	10003
>>>	HAS CONCEPT MOD	CODE	(G-C171, SRT, "Laterality")	(G-A100, SRT, “Right”) or (G-A101, SRT, “Left”) or (G-A102, SRT, “Right and left")	10003
>>	CONTAINS	CODE	(111031, DCM, "Image View")	See Table 106 - MAMMOGRAPHY VIEW CODES	10003
>>>	HAS CONCEPT MOD	CODE	(111032, DCM, "Image View Modifier")	See Table 107 - MAMMOGRAPHY VIEW MODIFIER CODES	10003

NL	Rel with parent	VT	Concept name	Value	TID
>>	CONTAINS	CODE	(123014, DCM, "Target Region")	(T-04000, SRT, “Breast”)	10003
>>	CONTAINS	NUM	(111634, DCM, "Half Value Layer")	Units = (mm, UCUM, "mm") Value = Half Value Layer	10003
>>	CONTAINS	NUM	(111636, DCM, "Entrance Exposure at RP")	Units = (mGy, UCUM, "mGy") Value = entrance dose	10003
>>	CONTAINS	CODE	(113780, DCM, "Reference Point Definition")	(13964, DCM, “At Surface of Patient”)	10003
>>	CONTAINS	IMAGE	(113795, DCM, "Acquired Image")	Reference (SOP Class and SOP instance UID) to the images part of this irradiation event. Row repeated for each image to be referenced.	10003A
>>	CONTAINS	NUM	(111631, DCM, "Average Glandular Dose")	Units = (mGy, UCUM, "mGy") Value = AGD of the irradiation event.	10003B
>>	CONTAINS	NUM	(113768, DCM, "Number of Pulses")	Units = (1, UCUM, "no units") Value = number of pulses in the irradiation event.	10003B
>>	CONTAINS	NUM	(113793, DCM, "Pulse Width")	Units = (ms, UCUM, "ms") Value = pulse width. Row repeated for each pulse in the irradiation event.	10003B
>>	CONTAINS	NUM	(113742, DCM, "Irradiation Duration")	Units = (s, UCUM, "s") Value = time between the start of loading time of the first pulse and the loading time trailing edge of the last pulse.	10003B
>>	CONTAINS	NUM	(113733, DCM, "KVP")	Units = (kV, UCUM, "kV") Value = kVp of the pulse. Row repeated for each pulse of the irradiation event.	10003B
>>	CONTAINS	NUM	(113734, DCM, "X-Ray Tube Current")	Units = (mA, UCUM, "mA") Value = tube current of the pulse. Row repeated for each pulse of the irradiation event.	10003B
>>	CONTAINS	NUM	(113824, DCM, "Exposure Time")	Units = (ms, UCUM, "ms") Value = exposure time from x-ray start to end for the irradiation event.	10003B
>>	CONTAINS	NUM	(113766, DCM, "Focal Spot Size")	Units = (mm, UCUM, "mm") Value = focal spot size	10003B
>>	CONTAINS	CODE	(111632, DCM, "Anode Target Material")	(C-150F9, SRT, “Molybdenum or Molybdenum compound”) or (C-167F9, SRT, “Rhodium or Rhodium compound”)	10003B
>>	CONTAINS	CONTAINER	(113771, DCM, "X-Ray Filters")	This container and its nested items are repeated for each pulse of the irradiation event.	10003B
>>>	CONTAINS	CODE	(113772, DCM, "X-Ray Filter Type")	(113650, DCM, “Strip filter”)	10003B

NL	Rel with parent	VT	Concept name	Value	TID
>>>	CONTAINS	CODE	(113757, DCM, "X-Ray Filter Material")	(C-150F9, SRT, “Molybdenum or Molybdenum compound”) or (C-137F9, SRT, “Silver or Silver compound”) or (C-127F9, SRT, “Copper or Copper compound”)	10003B
>>	CONTAINS	NUM	(113790, DCM, "Collimated Field Area")	Units = (m2, UCUM, "m2") Value = collimated area at detector plane.	10003B
>>	CONTAINS	NUM	(113788, DCM, "Collimated Field Height")	Units = (mm, UCUM, "mm") Value = collimated height at detector plane	10003B
>>	CONTAINS	NUM	(113789, DCM, "Collimated Field Width")	Units = (mm, UCUM, "mm") Value = collimated width at detector plane	10003B
>>	CONTAINS	NUM	(111635, DCM, "X-Ray Grid")	(111643, DCM, “Reciprocating grid”)	10003B
>>	CONTAINS	CODE	(113956, DCM, "CR/DR Mechanical Configuration")	(113954, DCM, “Upright Stand Mount”)	10003C
>>	CONTAINS	NUM	(112011, DCM, "Positioner Primary Angle")	Units = EV (deg, UCUM, "deg") Value = positioner primary angle	10003C
>>	CONTAINS	NUM	(111633, DCM, "Compression Thickness")	Units = (mm, UCUM, "mm") Value = compression thickness	10003C
>>	CONTAINS	NUM	(113737, DCM, “Distance Source to Reference Point”)	Units = (mm, UCUM, "mm") Value = distance to the reference point (defined as surface of patient in TID10003)	10003C
>	CONTAINS	CODE	(113854, DCM, "Source of Dose Information")	(113856, DCM, “Automated Data Collection”)	10001

13 Revision History

Reference	Date	Main Reasons of Change
DOC2512847 rev 1	January 2021	Initial release of the document.
DOC2512847 rev 2	April 2021	Applicability to system version 7.7.60.

Manufacturer and Manufacturing site:
GE MEDICAL SYSTEMS SCS
283 RUE DE LA MINIERE
78530 BUC – FRANCE

www.gehealthcare.com